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Editorial

The Physiology and Pathology of Unusually High Intakes of Nutrients

In his summing up of the Conference on Protein Nutrition held in New York in 1957, Stare[1] referred to nutrient intakes which are minimum, optimum or excessive. Whereas much is known of the physiology and pathology of nutritional deficiencies, far less is known of the effects of habitually excessive intakes of nutrients. Experimentally, of course, much may be learned on this subject, but uncertainty over the extent by which findings may be extrapolated to man limits the value of animal studies. In this particular field enlightenment on many problems may be forthcoming from careful studies of certain African populations, primarily because of the gross diversity of diet which varies from one territory to another, and frequently within the same territory. Examples of some of these interesting situations follow.

Excessive consumption of protein and fat are found among nomadic tribes dwelling in Somaliland and Eritrea (northeast Africa) who, for much of the year, subsist largely on milk from goats and camels. Publications[2–4] indicate consumptions of 2.5, 4 and even up to 9 L. per day. On the basis of the composition of goats' milk (3.3 per cent protein, 4.8 per cent fat) these volumes supply protein and fat intakes of 83 gm. and 120 gm., 132 gm. and 192 gm., and 297 gm. and 432 gm., respectively, and provide about 25 to 50 per cent of the total calories. From the limited information provided, it does not appear that these excessively high intakes are deleterious, but obviously, comprehensive studies are urgently required. This is particularly the case with the high fat intake, which understandably touches on one of the most controversial questions in nutritional science at the present time. If the expected ramifications in blood lipids, arterial atherosclerosis, and ischaemic heart disease are not proved, it could be inferred that, contrary to a strong body of current opinion, a high intake of animal fat *per se* need not be harmful.

The physiology and pathology of excessive carbohydrate consumption, in the presence of low intakes of other nutrients, have been the subject of much inquiry. In very young children, the adverse picture is fairly well known and understood. At the same time, the ill effects of diets which are calorically satisfactory but habitually grossly high in carbohydrate, as among Africans whose staple foods are cassava, yams, plantains, etc., are less well known, and there is much uncertainty over interpretation of the prevailing stigmas. There is much the same insufficiency of knowledge in regard to the preponderant carbohydrate moiety in the diets of those who consume large quantities of cereal.

There is a high intake of crude fiber among Africans in numerous regions. This results,

inter alia, in rapid passage of fecal material and in voluminous stools being voided more than once a day. It has been speculated that this high intake, directly and indirectly, has many ramifications in features as diverse as blood lipids,[5] the low incidence of eclampsia,[6] and the relatively low incidence of carcinoma of the large intestine.[7]

Low intakes of calcium are usual in African populations. But the nomadic groups in northeast Africa, already referred to,[2–4] consume several grams of calcium per day. Some of us have noted the low calcium intake of the Bantu, the relatively low levels of serum calcium,[8] the lesser severity of atherosclerosis and especially of aortic calcification, and the negligible mortality from coronary heart disease. Accordingly, we have wondered whether, of the numerous possible influencing factors, the much higher calcium intake of Western peoples is altogether innocuous.[9] Research on these nomadic groups at least would afford an answer as to whether or not a grossly high intake of calcium *per se* is deleterious.

The very high iron intake of the South African Bantu (as much as 100 to 200 mg. per day) and the remarkable phenomenon of siderosis (affecting as much as three-quarters of the adult population), together have been the subject of a number of publications.[10,11] Whether or not the excessively high iron intake (apparently decreasing in urban areas) is ultimately toxic is the object of much research but the interpretation of the results remain unsettled.

Certain Bantu groups are habitually high consumers of plant ashes or salt or both. Whether or not such intakes promote the hypertension so common among these people,[12] and share in the responsibility for the high mortality from cerebral vascular disease,[13] awaits investigation.

A number of isolated Bantu groups consume highly saline water, far higher in mineral content than orthodox limits for potability. Small communities at Kukong, in the South-central Kalahari Desert habitually and exclusively drink water of this type. No serious study has been made of possible ill effects. In certain of these regions the highly saline water, in addition, has a high concentration of fluorine.

Heavy consumers of palm wine, as among the Warri in Nigeria, have an excessive intake of vitamin A, far higher than the recommended dietary allowances.[14] The effects of this excessive intake are not known.

While the amount of vitamin D ingested by most African populations is negligible, that derived from exposure to radiation must be at least adequate, and presumably accounts for the rarity of rickets and osteomalacia among rural dwellers.[16] Calcification in groups who wear negligible clothing and who experience a plethora of sunlight has not been studied.

Consumption of fermented cereal preparations is widespread in Africa, resulting in high intakes of several components. Bantu workers at this Institute consume daily an average of about 2 L. sour porridge (*magou*) and 1.5 L. kaffir beer. The alcohol ingested may be 45 to 55 ml. per day, an intake higher than the 30 ml. average amount of alcohol ingested by the drinking population of the United States.[15] In such populations as the Bantu, the metabolic and pathologic ramifications of excessive alcohol ingestion (as well as of acidity, pH values are 3 to 4) are not known.

The foregoing examples, and many others which could be adduced, draw attention to a large area of nutritional science in which objective information is defective. It may be argued that such knowledge, even when secured, will refer primarily to the relevant dietary contexts studied, and that the direct application of such knowledge to Western dietary patterns will be unjustifiable. On the other hand, it may be countered that almost all if not all the situations cited bear directly or indirectly on subjects upon which there is much difference of opinion, e.g., the significance of very high protein feeding in kwashiorkor, high animal fat intake in ischaemic heart disease, excessive iron in idiopathic haemochromatosis and transfusional siderosis, high intakes of calcium and vitamin D in idiopathic hypercalcaemia of infants, excessive salt intake in hypertension and cerebral vascular disease, fluorine in relation to fluoridation of water supplies, and so forth. Careful study of the

situations detailed cannot therefore be otherwise than highly rewarding. Not least will they tell us more of man's enormous capacity for dietary adaptation.

Appropriate regions for all these investigations, and for many other intriguing problems, as already indicated, are found readily in Africa, with and without other variables, e.g., stress from excessive heat and humidity, single and multiple parasitic infestions, progressive urbanisation, and so forth. But Africa is on the move, so to speak, and is no longer static. Vast forces of change are at work, the existence and operation of which imply that the nutritional situations described may no longer prevail a generation hence.

Obviously, these situations are far from being suitably exploited for much needed information. In diffidence, one looks askance at the huge research potential now being devoted to animal experimentation in most Western countries, with all the accompanying detail and minutia, when such wide fields of human nutrition are ripe for study, but remain unharvested.

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Diet and Atherosclerosis

Variations on a Theme

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OUR BEST HOPE to arrest, retard or prevent atherosclerosis lies in discovering the reasons for geographic, ethnic, and constitutional variations in the frequency and degree of the disease.

Many countries either lack statistics or have statistics that are not reliable. Results of medical and anatomic surveys from the same area will differ: To the clinician atherosclerosis presents itself in its complications caused chiefly by reduction of a vascular lumen; the pathologist evaluates the underlying anatomic alteration, viewing the whole circulatory system. The limitations of morbidity statistics are obvious. Mortality statistics are worthless unless they are based on necropsy data. But even autopsy protocols will have limited value until all pathologists will describe the blood vessels in detail, using uniform grading of alterations. The International List of Causes of Death and the currently used death certificates hinder rather than further the epidemiologic study of atherosclerosis.

If one wants to learn about the occurrence of atherosclerosis in a distant land he must journey there. Two travelers viewing the same scenery may gain different impressions, and chances are that they will not see the same things. The interests of a nutritionist, cardiologist, and pathologist may overlap, but their reports will be tinted by their specialties.[1,2]

This pathologist, whose avocation is the study of various aspects of atherosclerosis, and his wife, who for decades has been exposed to discussion of atherosclerosis but whose interest lies with markets and kitchens, went to the Far East in search of information about atherosclerosis.

We visited Tokyo, Nikko, Kyoto, Nara, and Osaka in Japan, Bangkok in Thailand, and, on the way, Hong Kong. Many lectures were given and conferences were held at Nihon, Keio, and Tokyo Universities in Tokyo, the Osaka Medical School in Osaka, and Chulalongkorn and Siriraj Medical Schools of Bangkok. Several hospitals were visited in each city including Victoria, Hong Kong. Marketplaces, hospital kitchens, the food of patients, of hospital employes, and of the people in homes and on the street were scrutinized. Japanese, Cantonese, Pekinese, Shanghai, Hong-Kong Chinese, Thai, and "Western" foods were eaten in elegant restaurants, in common and primitive eating places, in hospital dining rooms, and in private homes. Secretaries of Health, nutrition experts, deans of medical schools, teachers at medical schools, hospital directors, clinicians, pathologists, residents, medical students, nurses, and people from various walks of life were questioned extensively.

To discuss Hong Kong with regard to atherosclerosis would be futile. Differences in population (native Chinese, immigrant Chinese, immigrant Hindu, British, others, and mixtures), economic status (from wealth to utter poverty) and way of life (from hut to palatial home) are far too great to allow evaluation of available data. Registration of birth, marriage, or death of humans is not obligatory. Curiously, ducks are either registered (for ex-

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port) or not registered ("dead"). "Atherosclerosis is not a problem in Hong Kong. Not even tuberculosis presents a problem. The main concern is with malnutrition, hepatic disorders, parasitic diseases and cancer."[3]

Japan and Thailand warrant discussion because both countries lie in the Far East but have little in common. Their capitals are more than 2,500 miles apart. Japan lies in the temperate zone; Thailand is in the tropics. Both are monarchies and they may have common political interests. Buddhism is the dominant religion in both countries, but 90 per cent of the Japanese not only are Buddhists but also are devoted to Shintoism.

JAPAN

Diet

Japan has a rather uniform population, in which there are few foreign elements. Diet also is uniform, differences being quantitative rather than qualitative, depending on the economic level. There is little variation between regions or between rural and urban diets. The average daily intake is 2,104 calories, with a minimum of 2,025 and a maximum of 2,176.[4] Fat provides, on the average, 8.6 per cent of all calories, while proteins contribute 12.8 per cent and carbohydrates 78.8 per cent. The average daily fat consumption is 20 gm., protein 77 gm. and carbohydrates 411 gm.

The fats most used are sesame oil, containing about 87 per cent unsaturated fatty acids; soybean oil, containing on the average 86.6 per cent; and peanut oil, with 82.9 per cent unsaturated fatty acids. The linoleic acid content of the three oils is 21 per cent, 51.2 per cent, and 29 per cent, respectively. The ratio of linoleic acid to saturated fatty acids is 1.6, 3.9, and 1.7, respectively.[5]

Total fat consumption is low, and total protein intake is not very high. Two thirds of the protein come from fish and vegetables, while only one third is obtained from meat. Fish often is eaten raw and many other foods are eaten raw or cooked only slightly. In preparing sukiyaki the cooking utensil is greased lightly. Lean beef is fried, but cooking time is short; it may be dipped into raw egg. Green vegetables, spinach, eggplant, chestnuts, gingko nuts, onions, mushrooms, and plenty of rice are eaten. The rice is unseasoned, boiled, and dry. During a full course dinner, usually served in a restaurant, the Japanese will eat two or three bowls of rice. It is the main source of carbohydrates in his diet. Two or more soups are served with either sukiyaki or tempura. One may be clear, flavored with a slice of lemon, while another may contain 20 or 30 tiny freshwater mussels in shells and be flavored with soy sauce. A third soup may have eight ingredients: mushrooms, seaweed, a green vegetable, chestnuts, tofu (soybean curd cake), morsels of fish, shrimp, and chicken. Sake (rice wine) is served hot in small cups and cooking wine is used to flavor the meat dish, sukiyaki. Tempura differs in the main course which consists of fritters of shrimp or prawn, and also fish. This food is fried lightly in sesame oil. Besides sake, good beer is served and, of course, tea. Every meal begins and ends with tea.

But such meals are eaten by a middle-class family only once or twice a year on a special occasion. Otherwise, one meal consists of a bowl of rice and another of cold boiled rice wrapped in seaweed, and dried fish and soup. The younger generation, office girls, and some housewives in Western clothes will sometimes eat a light luncheon of a fruit-salad sandwich or sherbet in a downtown tearoom. The evening meal, again, will be traditionally Japanese.

At times Americanization has progressed to absurdity: In a night club in Kyoto we saw a teenage geisha girl in traditional garb "jitterbugging." However, eating habits have been influenced only slightly. Milk and egg consumption is negligible. The middle-class Japanese does not consume over half a pound of meat per month. At night, young people stop at open stalls, off the streets, to buy fish or meat broiled quickly over charcoal. During the day many will eat excellent French-type pastry with their tea, but no desserts are served after meals. A few grapes and two or three slices of papaya or persimmons are served instead of dessert. Green-leaf-tea sherbet is now fashionable in better restaurants.

Life in a Japanese inn, a "ryokan," was fascinating. Each meal consisted of several dishes. Breakfast started with tea, then a

small dish of cold stringbeans with peanut butter was followed by a plate containing two tiny cold fish, a piece of parsnip, a pickle or ginger, and two cubes of sweetened colored soybean cakes. Next came a bowl of soup with mussels, a bowl of rice, another soup with tofu and a piece or two of chicken, more rice, and more tea. Plenty of tea was served. Luncheons and dinners followed this general pattern. The quantity of each meal was large; the total nutritive value was low; the meals were not filling.

Cardiovascular Diseases

On the diet described the Japanese are lean. Some of the more corpulent men have spent a year or two in the United States. The average Japanese is not undernourished, but he is somewhat less than "well nourished." His height is less than that of the American and so is his weight.

Cardiovascular diseases occurred in 14.5 per cent of all hospital patients in 1954. Today, the figure will be higher. Since 1936, the incidence of angina pectoris, myocardial infarction, and renal and cerebrovascular diseases has been steadily rising. The ascending curves were slightly disturbed by a drop in frequency during the war years of 1942–1945 and into the following year. Since 1949, the increase has been steady and marked. Curves for anginal symptoms, whether spontaneous or elicited by effort, and for myocardial infarction run parallel.

The incidence of cerebral hemorrhage is twice that encountered in North America; it is more frequent than myocardial infarction. Hypertension, as such, also is more common in Japan than in the United States. In contrast to atherosclerosis, which has a uniform distribution throughout Japan, hypertension is more common in the North than in other parts of the country. Clinical data[6] are matched by anatomic data.[7] Both types were collected by members of a special Committee of the Ministry of Education. Cooperative studies from various districts deal not only with atherosclerosis of coronary arteries but also with that of the aorta, of the basilar and renal arteries, and myocardial infarction.

The death rate from heart disease was 60.4 per cent in 1955. The ratio of males to females was about the same as in America as far as myocardial infarction and atherosclerosis are concerned. In several institutions, especially in Osaka, vascular lesions are being rated according to acceptable criteria, and Japanese observations match those of American investigators. Positive correlation of the degree of atherosclerosis between coronary arteries and aorta is close to 80 per cent. Coronary disease appears earlier or at the same time as aortic disease. Basilar and renal artery disease develops later and more slowly than that of coronary arteries. By and large, the blood vessels of Japanese are comparable with those of Americans.[8,9] The discrepancy between the clinical[6] and anatomic[7] data is apparent in reports from Kyoto: According to clinical data the incidence of anginal pain and myocardial infarction is much higher than elsewhere (this is explained by selection of patients), while the necropsy incidence of coronary sclerosis and of myocardial infarction is much lower than in other areas of Japan.

Interest in hypertension and atherosclerosis is high. It manifests itself in numerous publications dealing with anatomic, clinical, and experimental aspects of these diseases. Intensive research is carried on everywhere, and lectures were followed by eager questions. The questions and papers presented by the Japanese revealed good knowledge of bibliography. Many symposia were arranged to provoke the guest's discussion remarks. Efforts are being made to organize a study group along the lines of the American Society for the Study of Arteriosclerosis.

THAILAND

Diet

Thailand presents a different picture from that of Japan. There is a substantial Chinese population in Bangkok, and Chinese are infiltrating the northern provinces. In the South, there are some Moslems besides the Thai. Dietary habits are not uniform and differ in quality as well as in quantity. Rice eaten in the North is sticky and glutinous, and contains 1–2 per cent protein, while the rice eaten in Bangkok

is polished. In the North, the main source of carbohydrates is rice, but in Bangkok about 10 per cent of carbohydrates originates from sources other than rice. Along the coast fish consumption is higher and meat consumption lower than in the rest of the country.

Thai statistics are confusing. According to data considered valid until 1957,[10] in Bangkok the average daily intake per capita was 2,000 calories, with fat contributing 13 per cent, protein 12 per cent, and carbohydrates 75 per cent of the total calories. The same report showed average daily consumption of fat was 28 gm.; of protein, 60 gm.; and of carbohydrates, 420 gm. In one rural area, daily intake was 1,746 calories with 6.7 per cent from fat, and in another 2637 with 5 per cent from fat.

Statistics for 1958 record the average daily per capita intake for Bangkok as 1,209 calories, with fat providing 27 per cent, protein 13 per cent, and carbohydrates 60 per cent of the total. The average daily ingestion of fat is given as 42 gm.; that of protein, 47 gm.; and that of carbohydrates, 208 gm. (which would add to 1486 calories). Differences in these two statistics are understood as one learns that the second survey does not include Chinese (which does not imply that the first survey did) and that "in Bangkok, only 75 families among the random sampling of 225 Thai families were cooperative."[11] In the Sansai district of Chiengmai Province in the North, 80 families were studied. There the total intake was 1951 calories, with 11 per cent contributed by fat (22 gm. daily), 10 per cent by protein (45 gm.), and 79 per cent by carbohydrates (340 gm.).

In a table supplementing these data the per capita intake of carbohydrate providing food is 491 gm., comprised of 487 gm. of raw rice, 3 gm. of other starchy food, and 1 gm. of sugar.[11] The same table shows a daily consumption of 49 gm. of green leaf vegetables and 20 gm. of fresh fruit for Chiengmai, while the accompanying text cites multiple vitamin deficiencies.[11] It was explained to us that the survey had been made in summer when vegetables and fruits were plentiful and actually replaced some other foods. In Huarea, one of ten villages of Muang district in Ubol Province in the North, 32 families were studied. Their average intake was 1,722 calories, with but 3 per cent contributed by fat (5.5 gm. daily), 11 per cent by protein (46 gm.), and 86 per cent by carbohydrates (344 gm.). The table indicates 510 gm. of raw rice as the sole source of carbohydrates. Correlation of diet with health has not been possible to date because of refusal of physical examination by the populace. The work of the nutritionist is trying, indeed.

Moslems and Chinese have not yet been studied. The Moslems in Bangkok are tall and lanky but appear well nourished. The Chinese of Bangkok are prosperous and eat better and more than the Thai. They weigh more than the Thai but, of course, they are differently built, having heavier and longer bones. The girls in a brothel seemed well nourished; the men in an opium den were emaciated. The Thai are small, slender, muscular, and well nourished. Some of the men are stocky; few are obese. Eating habits belie the statistics. Walking the streets one has the impression that Thai and Chinese cook and eat all day long. The Thai kitchen is strongly influenced by Chinese and Western cooking, and few restaurants in Bangkok list Thai dishes. The main dish is rice but there is a piece of meat in every bowl, be it that of a hospital nurse or that of the riksha boy, and the food is hot from the use of spices. Bangkok food is greasy; everything is fried in deep fat. On the streets, meats, bananas, and doughnuts are fried in lard.

Lard is the main source of fat (43 per cent saturated fatty acids). Some coconut oil is used, with about 91.2 per cent saturated fatty acids[5] (the lowest figure for saturated fatty acids in coconut oil is 82 per cent). The linoleic acid content of lard is 10 per cent, that of coconut oil but 2 per cent; the ratio of linoleic acid to saturated fatty acid is 0.23 for lard to 0.02 for coconut oil.

Cardiovascular Diseases

While there are no statistics concerning the incidence of atherosclerosis, the rarity of clinical disease is pointed out by all physicians in Thailand. Clinicians can count on their fingers the number of patients with myocardial infarction or angina pectoris. Myocardial

infarction is a rare postmortem diagnosis. The aortae appear "younger" at necropsy than those of Americans of corresponding age. Complicated atherosclerotic lesions are seen in the aged only. Since older people shy away from hospitals, the hospital population is younger in Thailand than in the United States. Our repeated question as to the longevity in Thailand remained unanswered. The honest reply to this and many other relevant questions was monotonously the same: "Don't know."

The low incidence of atherosclerosis is even more surprising when one learns that diabetes mellitus is common. Physicians encounter the renal complications of diabetes but not those in other sites. We could not ascertain whether diabetics develop hypercholesteremia, nor did we hear about blood cholesterol of nondiabetics. Hypertension is common, occurring in 6 to 7 per cent of hospital patients in 1954–1955. Necropsy findings seem to support clinical observations.

Atherosclerosis does not constitute a problem in Thailand, for the present at least. No published data are available. Because of the paucity of clinical and anatomic material, interest in the subject is limited. Lectures were well attended and questions were asked, but only those who had had an opportunity to observe the magnitude of the problem in the United States showed genuine interest in the topic. There is no research in this field in Thailand, since lack of physicians and inability of the two medical schools to provide sufficient physicians make it imperative to concentrate on medical care and teaching.

COMMENT

Japan and Thailand represent two extremes. According to our prevailing concept the Japanese diet can be labeled "antiatherogenic." Subject to future correction based on acceptable statistics, the diet in Thailand can be labeled "atherogenic," in spite of the total caloric intake, which is lower than in the United States. The Japanese diet is low in calories, fat, and cholesterol. Food is heated little or not at all. Fried food is rare. The fat used is rich in linoleic acid and other unsaturated fatty acids. The diet in Thailand, in Bangkok at least, is rich in fat and cholesterol. Fried food is common, and all food is greasy. The fat used contains little linoleic acid and few other unsaturated fatty acids. The Japanese eat dry rice and green-leaf-tea sherbet; the Thai eat greasy rice and meat and coconut ice cream. The physical appearance of the people reflects the diet. The composition of the diet can influence that of the blood.[12–14] The parallelism, if it exists at all, goes no further; atherosclerosis is common in Japan and rare in Thailand.

Evidence to support the concept that high levels of plasma cholesterol, per se, in main are atherogenic is far from conclusive. Circumstantial evidence, however, indicates that the kind, or amount, of dietary fat is in some way related to some stage of atherosclerosis in man. A reduction in intake of the more saturated fats in the diet may ultimately prove desirable for health but is not yet mandated by currently available evidence.

This latest, frequently quoted, cautious statement by the Food and Nutrition Board of the National Research Council[5] may have to undergo revision.

As a sentimental afterthought of an all but sentimental journey, one may wish to be allowed to borrow from the three-faced Buddha and thus be able to see more, hear more, and ask more questions. And one may wish to imitate the Buddha with eight arms and thus be able to hold more than one scale to weigh all the information and impressions in the hope of arriving at valid conclusions.

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Some Comments on the American Diet and Household Consumption Data

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THE PUBLICATION in 1957 by the U. S. Department of Agriculture of a report[1] based on a nationwide survey of household food consumption made from April through June 1955 has resulted in considerable publicity by governmental and cooperating private agencies designed to reassure the public of the adequacy of the American diet and, incidentally, increase the consumption of food. The implication contained in many newspaper articles was that it is practically impossible for Americans to consume inadequate diets if they make full use of available foods. The purpose of this brief communication is to point out that many Americans do in fact exist on inadequate diets, and that an overabundance of foodstuffs and food consumption cannot be relied upon to correct the situation.

The criterion for an assuredly adequate diet used here is the Recommended Dietary Allowances (revised, 1953) of the National Research Council.[2] We use the Allowances in this way because they are so used by the Department of Agriculture in the study referred to, in the dietary surveys to be referred to in this paper, in pertinent governmental releases and by the Council on Foods and Nutrition of the American Medical Association in its discussion of vitamins as supplemental and therapeutic agents.[3] The last named agency uses the Allowances as revised in 1958.[4] (Using the 1958 revision of the Allowances would strengthen, not weaken, our position, since this revision reduces the allowance of calories per pound of body weight for adults.)

The Department of Agriculture report[1] shows the amounts of nutrients in the food that came into household kitchens for consumption, corrected for cooking losses but not for kitchen and plate waste. By dividing household consumption by the number of persons in the household, nutrients available per capita (Table I) were obtained. Nutrients available per "nutrition unit" also were calculated (Table I).

The procedure used for computing nutrition units (or adult-male equivalents) was to express as relatives the National Research Council Allowances for a particular nutrient for persons in each sex and age group, using the allowance for the young adult male as 1.0. For each household these relatives were then multiplied by the number of persons (twenty-one-meal-at-home equivalents) in the appropriate sex-age group; the sum of these products giving the number of nutrition units per household. Obviously, the determination of nutrients available per nutrition unit provides much more meaningful data than do per capita figures which do not allow for the composition of the population.

REPORTED FINDINGS

From Table I it can be seen that, on the average, there is a gross excess in the household consumption per nutrition unit of all nutrients studied, except calcium, as compared to the 1953 National Research Council Allowances as adjusted for average twenty-one to thirty-four year old males in the United States.[5] In spite of this fact, from 7 to 29 per cent of the households had diets not meeting the Allowances for at least one nutrient. This means, of course, that many households were consuming nutrients greatly in excess of the averages.

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TABLE I

Nutrients Available per Capita and per Nutrition Unit Compared to Adjusted 1953 National Research Council (NRC) Allowances

	Calories	Protein (gm.)	Calcium (gm.)	Iron (mg.)	Vitamin A Value (I.U.)	Thiamine	Riboflavin (mg.)	Niacin (mg.)	Ascorbic Acid (mg.)
Nutrients available per capita	3,120	103	1.13	17.3	8,680	1.53	2.23	18.6	108
Nutrients available per nutrition unit	4,390	121	1.00	19.3	9,960	2.15	2.65	25.8	117
1953 NRC allowances*	3,000	75	0.8	12	5,000	1.5	1.9	15	75
Per cent of households under 1953 NRC allowances*	12	8	29	10	16	17	19	7	24
Per cent excess of consumption per nutrition unit over 1953 NRC allowances*	146.33	161.33	125	160.83	199.2	143.33	139.47	172	156

* Adjusted for average twenty-one to thirty-four year old males in the United States.[5]

If the percentage of households not consuming (that is, taking into the kitchen) quantities of nutrients meeting the National Research Council Allowances represented the total of inadequate diets in the United States, the problem would be a relatively minor one, the proper approach to which is suggested by the data in Table II compiled from the 1957 Department of Agriculture report.[1]

Although households "consuming" diets inadequate in at least one nutrient occur in all economic brackets, the prevalence of inadequacies varies directly with urbanization and inversely with income and presumably with education (Table II). It is interesting to note that in the annual income range of $2,000 to $10,000 (for information on households with annual incomes lower than $2,000 refer to the original report[1]) nutrients consumed by farm households are little affected by income, except for vitamin A and ascorbic acid, in which respects the farmer does not do as well as the urban dweller. It may be that this is more a matter of education than income.

CALORIES

It would appear, at first glance, that the problem is entirely one of economics and consumer education; this, however, is not the whole story. The situation is complicated by

TABLE II

Distribution of Inadequate Household Consumption by Urbanization and Income

Annual Income	Protein Under 75 gm. (%)		Calcium Under 0.8 gm. (%)		Iron Under 12 mg. (%)		Vitamin A value Under 5,000 I.U. (%)		Thiamine* Under 1.5 mg. (%)		Riboflavin* Under 1.9 mg. (%)		Niacin* Under 15 mg. (%)		Ascorbic Acid* Under 75 mg. (%)	
	U†	F‡	U	F	U	F	U	F	U	F	U	F	U	F	U	F
$2,000 to 2,999	13	7	42	25	14	4	18	23	22	9	30	17	11	7	30	29
3,000 to 3,999	6	6	31	22	10	4	15	17	19	9	18	14	5	6	24	28
4,000 to 4,999	4	3	27	24	9	2	11	13	15	5	16	11	5	0	19	20
5,000 to 5,999	2	8	24	16	7	4	9	17	18	10	12	12	4	4	19	23
6,000 to 7,999	4	5	22	33	9	0	11	15	19	6	14	15	5	2	16	19
8,000 to 9,999	5	3	28	21	9	3	9	10	21	5	17	15	4	3	11	10
10,000 and over	1	0	17	9	6	0	3	13	15	9	12	0	2	0	7	17

* Cooking losses deducted.
† U = Urban.
‡ F = Farm.

the fact that the apparent abundance of other essential nutrients is associated with a gross overabundance of calories. The reported average household consumption of calories per nutrition unit[1] is 4,390, or 146.33 per cent of the adjusted 1953 National Research Council Allowances (3,000 calories). This is a great deal more than the average person eats or can eat. Friedemann et al.,[6] in four experiments, found the caloric requirement for weight equilibrium of soldiers engaged in moderate activities to range from 2,812 to 3,304 calories, with an average of 3,175 calories. The requirements of troops in basic training ranged from 3,698 to 4,227 calories, with an average of 4,066 calories. "This perhaps represents the upper limit of caloric requirements for sustained activities at a high level over a period of time."[6] Young et al.[7] found the caloric intake of sixty-two Cooper Union male students, aged twenty-one years or more, to average 2,604, while that of fourteen Cornell University male students in the same age group averaged 2,529 calories. If the household food consumption data of the U. S. Department of Agriculture[1] are correct, it is apparent not only that a great deal of the food, at least one-third of the calories consumed by the average household, is wasted, but also that this waste is obligatory, if all of us are not to become obese.

Some will react to this statement with: "Oh well, these excess calories just represent drippings, fats cut off meat, cooking fats and oils that are discarded. They carry insignificant amounts of other nutrients with them." A little arithmetic, however, shows that this is not so. In the average American diet, fat provides 40 per cent or more of the calories[7,8] or at least 1,200 fat calories in a 3,000 calorie diet. The U. S. Department of Agriculture household consumption level per nutrition unit of 4,390 calories includes 1,931.6 fat calories. This means that in reducing our caloric consumption from 4,390 to 3,000 calories we are discarding not more than 731.6 fat calories and not less than 658.4 calories from other foods. Also, one-half of the fat available in the American diet is "hidden fat," much of which is not readily excluded from the diet without excluding other nutrients. Thus, 32.3 per cent of the fat consumed by American households is contained in meat (excluding bacon and salt pork), poultry, fish, eggs, dry beans and nuts; 18.1 per cent is found in milk, cream, ice cream and cheese, and 13.5 per cent in butter and margarine. All other foods, including other fats and oils, provide the remaining 36.1 per cent. According to the U. S. Department of Agriculture household consumption data, bacon, salt pork, cooking fats and salad dressings account for 26.4 per cent of the calories available from fat, or a total of 510 of the 4,390 calories available per nutrition unit. If these four items were entirely omitted from the 3,000 calorie diet, an extremely unlikely situation, they could account for no more than 36.7 per cent of the discarded calories. It is apparent that a one-third reduction of the calories consumed in the average American household will of necessity bring about a variable reduction in the consumption of other essential nutrients.

RECENT STUDIES

Leverton and associates[8] have reported on the diets of 353 women in Illinois and Nebraska who were subsisting on diets containing on the average 1,936 calories. This is 39.5 per cent less than the per capita calorie consumption figure (3,200 calories) reported in the U. S. Department of Agriculture household consumption study.[1] It is pertinent that calories from table and cooking fats in the diets of the Illinois and Nebraska women were less than in the U. S. Department of Agriculture per capita diet by 41.7 per cent, about the same as the per cent decrease in total calories, while those from meat, poultry, fish, eggs, cheese, beans and nuts were 55.72 per cent, those from milk 51.7 per cent and those from bread and cereals 59.2 per cent less. There was a proportionate increase in calories from vegetables and fruits, with a slight absolute decrease, 280.72 calories compared to 320. There was both a proportionate and absolute increase in calories from sweets and desserts, 453.02 calories as compared to 396.8 in the U. S. Department of Agriculture per capita data. The diets of these women supplied, on the

TABLE III

Per Cent of Adults and Adolescents (Ages Thirteen to Twenty Years) Eating Diets Containing Less than Recommended Dietary Allowances (Revised 1953)*

Age Group and Sex	Number of Individuals	Calories	Protein	Calcium	Iron	Vitamin A	Ascorbic Acid	Thiamine	Riboflavin	Niacin
Less than 90 or 100 Per cent of the Allowances										
Adolescent females[9-12]	345	65.5	56.8	77.6	85.0	40.9	53.5	70.8	59.9	43.5
Adolescent males[9-12]	249	70.7	31.9	50.9	49.6	22.4	61.4	64.2	35.5	47.5
Adult females[9]	46	38.9	21.7	77.4	39.5	34.7	51.0	52.1	41.3	58.4
Adult males[9]	46	6.2	0.0	21.5	0.0	8.6	30.3	28.4	2.2	21.4
*Less than 66 or 69 Per cent of the Allowances**										
Adolescent females[9-12]	345	15.5	12.9	44.8	42.8	15.4	28.7	22.2	18.2	6.9
Adolescent males[9-12]	249	12.9	3.6	21.7	5.6	6.4	34.6	12.0	9.6	3.7
Adult females[9]	46	8.3	4.2	44.9	11.2	26.2	28.0	25.2	21.7	6.3
Adult males[9]	46	2.2	0.0	6.2	0.0	2.2	19.9	7.0	0.0	4.0

* Some workers reported percentages of subjects under 100 per cent, others under 90 per cent of NRC Allowances; similarly some used 66 per cent as the breaking point and others used 69 per cent. So that the total under 100 per cent and 69 per cent, respectively, is greater by an unknown factor than here reported.

average, 113 per cent of the protein, 90 per cent of the calcium, 147 per cent of the vitamin A, 91 per cent of the thiamine, 107 per cent of the riboflavin, and 133 per cent of the ascorbic acid recommended by the National Research Council in the 1953 revision of the dietary allowances. The margin of safety in the average diet of these women is, in every instance, considerably less than that indicated in the household consumption data (Table I), due in part to unwise food selection, but due primarily to the low caloric requirements of the women involved.

Leverton et al.[8] found that only seventy-eight (22 per cent) of the women had diets that provided 90 per cent or more of the National Research Council allowances for all six of the nutrients studied. These women had an average intake of 2,164 calories as compared to 1,936 calories for the entire group of 353 women. Their average diet was improved over that of the group as a whole by the consumption of more milk, meat and vegetables, but there was no concomitant decrease in the consumption of table and cooking fats and sweets and desserts. The calories from table and cooking fats were 276.86 for the seventy-eight women with the most adequate diets, as compared to 253.62 for the 353 women. The respective calorie levels for sweets and desserts were 465.05 and 453.02. It would appear that a substantial number of these seventy-eight may have been protected more by their good appetites than they were by any conscious efforts to select good diets.

DIETARY SURVEYS

Table I shows that the margin of safety (that is, the excess over National Research Council Allowances) is not large and may be non-existent for calcium, thiamine and riboflavin, and that there is considerable maldistribution of foods rich in ascorbic acid. We might, then, expect dietary inadequacies of these nutrients to be fairly common. Table III, which is a composite of a number of recent dietary surveys[9-12] bears this out. It also indicates a respectable incidence of dietary inadequacies of iron and vitamin A among females. Admittedly, Table III encompasses only a small fraction of the dietary studies which have been made, and includes a relatively small group of people, but we have reason to believe that it does reflect a fairly accurate picture.

Aside from the alarmingly high incidence of

inadequate diets among both adolescent and adult females, the most striking figures in Table III are those relating to the diet of the adult American male. He appears to be doing quite well indeed. Why, then, is his life expectancy so short? Why do so many American males die in their forties and fifties of degenerative vascular diseases? Could it be that he is being overfed by over-solicitous females to the detriment of his health? And, if this be so, what nutrients is he taking in excess to his own disadvantage? The only probabilities that need to be considered here are calories, fats and sodium chloride.

The high incidence of inadequate diets among adolescent girls and young women is of immediate concern. As pointed out by Stearns,[13] "The importance of good nutrition in this group is so great that no steps toward its improvement should be neglected. It appears certain that pregnancy wastage and neonatal mortality are greater when the nutrition of the mother is habitually poor."

SUMMARY

The U. S. Department of Agriculture report on household food consumption in 1955[1] indicates that the average American household is consuming more than a sufficient amount of all nutrients studied to assure its members an adequate diet. However, since the supply of other essential nutrients is associated with a gross excess of calories, at least one-third more than actually is eaten per "nutrition unit," and since, in fact, calorie discard is not accomplished in the home without an appreciable discard of other nutrients, it cannot be concluded from the U. S. Department of Agriculture report that household food consumption in the United States is such as to preclude the possibility of a high incidence of dietary inadequacies. Nor can it be argued that educational programs designed to increase the consumption of particular foodstuffs are the answer to whatever dietary problems may exist. The calorie requirements of the average American adult probably are at an all-time low, and are not likely to increase in normal times. As the U. S. Department of Agriculture report amply demonstrates, it is not at all difficult to persuade the consumer to purchase more food than he needs; however, this is quite a different matter from getting him to eat more calories than he requires or is accustomed to eating. Any nutritionist attempting to design a successful public health nutrition program must take cognizance of the fact that the addition of certain foods to the diet must be accompanied by the subtraction of an equivalent number of calories in the form of other foods. As pointed out by Leverton et al.,[8] "Actually the need is often for *decreasing* the energy value [of the diet] and *increasing* nutritive values."

Consumer purchasing power and educational level remain, as they always have been, important determinants of the incidence and distribution of dietary inadequacies in the United States.

Dietary inadequacies do exist and are common in the United States where there is a plethora of food and where obesity is considered to be a public health problem of the first order. They are particularly prevalent and serious among adolescent girls and young women. This problem cannot be solved simply by encouraging an increased consumption of food.

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A Forty-Day–550 Calorie Diet in the Treatment of Obese Outpatients

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TREATMENT of obesity is a two-stage procedure: weight reduction and maintenance of reduced weight. This paper deals with the first stage only and presents a rapid and efficient way to achieve weight reduction.

METHODS

All obese patients who were referred to the Endocrinological Outpatient Clinic of the Tel-Hashomer Hospital between July 1957 and July 1958 were treated according to the following plan unless they were less than eighteen years of age, or it was thought that they would not be able to follow the plan because of low intelligence. No other plan of treatment was proposed to any patient during this period.

The diet was that proposed by Simeons[1] and consisted of only two meals daily. Each meal consisted of: (1) 100 gm. of lean meat (veal, beef), chicken or fish, weighed raw, served grilled or boiled, (2) one normal serving of fresh seasonal vegetables, boiled or raw, (3) one rusk weighing 10 gm., (4) half a lemon, (5) an apple or orange or 60 gm. of other fresh fruit (below 15 per cent carbohydrate content).

Meals were taken at whatever time preferred by the patients, but patients were not allowed to save part of the meal for later consumption. In addition patients were allowed unlimited quantities of salt, pepper and water, as well as tea and coffee (unsweetened and without milk) during and between the meals. It was impressed upon them that strict adherence to the diet was essential. This diet furnishes about 500 to 600 calories daily. Patients were not informed of the caloric value of this diet nor were they allowed to substitute caloric equivalents.

The diet was prescribed for forty consecutive days. Patients were told that they could expect a weight reduction of about 10 kg. (22 pounds). They were not seen during the dieting period, but were instructed to continue their usual occupations and accustomed way of life. After forty days they were re-examined. Those who were still overweight and in need of a second course were instructed to preserve the attained weight: they were told to eat three meals a day and to weigh themselves daily, regulating food intake so as to avoid weight gain. Again, patients were not told to "count calories." After two months they were put on a second course. Of the forty-five patients, five completed two or more courses; several others are now in their second course.

In accordance with Simeon's plan,[1] 125 units (0.25 ml.) of gonadotropin (Antuitrin S, Parke, Davis & Co.) were given daily to thirty-nine of the patients; fourteen others received daily injections of saline. Patients were told that weight reduction would be due to the diet but that injections would help to curb their appetites. The injections were given at home by a nurse.

RESULTS

Forty-five patients started fifty-three courses. The data are summarized in Table I, arranged according to daily weight loss (column 11). Forty-seven courses (89 per cent) resulted in a loss of more than 150 gm. per day. Six patients (11 per cent of the courses and 13 per cent of the patients) lost less and were considered failures. Of the successful courses, sixteen resulted in a loss of 152 to 192 gm. daily and thirty-one in a loss of more than 200 gm. daily.

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TABLE I

1	2	3	4	5	6	7	8	9	10	11	12	13
No.	Initials	Age (yr.)	Sex	Height	Weight before Treatment (Kg.)	Percentage Overweight	Days of Diet	Weight after Treatment (Kg.)	Total Weight Loss (Kg.)	Weight Loss (gm./day)	Injections*	Remarks
1	H. I.	53	M	176	113.5	54	40	90.2	23.3	582	Ant	
2	W. H.	36	M	174	98.5	38	40	83.2	15.3	382	Sal	Difficult gait, post-polio
3	K. F.	43	F	151	83	68	30	72.4	10.6	353	Ant	Latent diabetes
4	T. N.	22	F	164	99	60	40	85	14	350	Ant	
5	W. E.	18	F	169	83	25	40	69.4	13.6	340	Ant	
6	K. S.	23	M	174	101	43	40	87.5	13 5	337	Sal	
7	H. B.	41	F	163	96.5	59	40	83.5	13	325	Sal	
8	S. A.	28	F	170	109.6	61	40	97	12.6	312	Ant	
9	L. B.	22	F	163	91.5	55	40	79.5	12	300	Ant	
10	H. I.	31	F	154	111	113	40	100	11	285	Ant	
11	B. N.	36	F	162	78	30	40	67.5	10.5	262	Ant	Diabetes
12	W. M.	22	M	178	108.5	55	40	98.3	10.2	255	Ant	
13	R. R.	25	F	153	97	88	40	87	10	250	Ant	
14	K. M.	28	F	156	74.5	36	40	64.5	10	250	Ant	
15	R. H.	42	M	167	87	34	40	77	10	250	Ant	
16	A. S.	22	F	157	98.5	80	36	39.8	8.7	242	Sal	
17	K. F.	34	F	151	73.3	48	28	66.7	6.6	232	Ant	
18	G. A.	27	F	149	82	71	40	73	9	225	Ant	
19	B. H.	26	F	154	84.5	66	40	75.5	9	225	Sal	Hyperostosis frontal. int.
20	M. A.	25	F	153	82	59	40	73	9	225	Ant	
21	H. I.	31	F	154	100	90	40	91	9	225	Ant	
22	K. E.	31	F	159	88	56	40	79	9	225	Sal	
23	A. R.	25	F	153	67.3	30	40	58.3	9	225	Sal	
24	G. T.	56	F	153	94	82	40	85.5	8.5	212	Ant	Diabetes
25	M. D.	35	F	148	73.5	60	40	65	8.5	212	Ant	
26	R. R.	25	F	153	80	55	40	71.5	8.5	212	Ant	
27	H. I.	31	F	154	127.5	142	40	119	8.5	212	Ant	Hyperostosis frontal. int.
28	B. I.	22	F	166	72.7	13	20	68.7	4	200	Sal	
29	R. R.	25	F	153	71.5	48	30	65.5	6	200	Ant	
30	H. I.	31	F	154	119	125	40	111	8	200	Ant	
31	E. B.	32	F	160	108.5	36	40	100.5	8	200	Ant	
32	B. B.	35	F	154	87.2	66	40	79.5	7.7	192	Sal	
33	K. H.	22	F	137	67.5	75	40	59.7	7.8	192	Sal	Ankylosis of tarsal joints; congenital deformity of legs
34	R. G.	52	M	162.5	96.7	60	40	89.2	7.5	188	Ant	
35	F. L.	31	F	157	89.5	65	40	82	7.5	188	Ant	
36	M. D.	35	F	148	81	73	40	73.5	7.5	188	Ant	
37	E. A.	20	F	155	67.5	16	40	60	7.5	188	Ant	
38	S. E.	20	F	150	71.1	45	36	64.5	6.6	186	Ant	
39	S. U.	34	F	150	107.3	120	31	101.6	5.7	184	Ant	Hyperostosis frontal int.
40	L. E.	35	F	161	79	34	40	72	7	175	Ant	
41	V. H.	31	F	148.5	66	39	40	59	7	175	Ant	
42	E. R.	32	F	160	100.5	71	40	93.5	7	175	Sal	
43	D. F.	35	F	158	85	30	40	78	7	175	Ant	
44	K. Z.	30	F	147	66.7	45	40	59.5	7.2	175	Ant	

TABLE I (*Continued*)

1	2	3	4	5	6	7	8	9	10	11	12	13
No.	Initials	Age (yr.)	Sex	Height	Weight before Treatment (Kg.)	Percentage Overweight	Days of Diet	Weight after Treatment (Kg.)	Total Weight Loss (Kg.)	Weight Loss (gm./day)	Injections*	Remarks
45	H. B.	41	F	163	82.4	34	34	76.8	5.6	174	Sal	
46	T. E.	35	F	162	79.7	32	40	73	6.7	167	Ant	
47	S. L.	35	F	162	91.2	52	40	85.1	6.1	152	Sal	
48	L. J.	29	F	160	83.5	44	40	77.5	6	—	Ant	Not successful
49	W. H.	39	F	160	105.6	81	40	100	5.	—	Ant	Not successful
50	S. R.	34	F	155	91	73	40	85.5	5.65	—	Sal	Not successful
51	W. H.	29	F	150	82	69	40	76.5	5.5	—	Ant	Not successful
52	A. M.	51	F	151	80	62	40	75	5	—	Ant	Not successful
53	H. Z.	33	F	155	80	52	40	78	2	—	Ant	Not successful

* Ant—Antuitrin S injection (see text). Sal—saline injections.

The patients' ages (column 3) were between eighteen and fifty-six years (mean—32.8 years). Age did not affect daily weight loss.

Six courses were completed by males (column 4). This small percentage of males is usual in dieting groups. Their mean daily weight loss was higher than the general weight loss (males —mean 332.3 gm./day, general—mean 237.8 gm./day [Table II]).

TABLE II
Average Daily Weight Loss

Over-all (47 successful courses)	237.8 gm./day
With saline injections (13 courses)	234.3 gm./day
With Antuitrin S (34 courses)	239.2 gm./day
Males (6 courses)	332.3 gm./day

Patients' weights before the course was started are recorded in column 6. Column 7 gives an idea on the degree of overweight in per cent. The normal weight was approximated as the patient's height in centimeters above 1 meter, less 5 per cent. It is evident that the amount of overweight had no influence on daily weight loss. This is clearly brought out by patient I. H. (Courses No. 10, 21, 27, 30) who started her first course weighing 127.5 kg. and lost 212 gm. daily. At the start of her second course she weighed 119 kg. and lost 200 gm. daily. Third course, weight 111 kg., loss 285 gm. daily; fourth course, weight 100 kg., loss 225 gm. daily. Column 9 lists the total weight loss in kilograms. It should be considered together with column 8, which shows the duration of the diets (some lasted less than forty days). Average total weight loss for forty days was 9.51 kg. (21 pounds).

Of the forty-seven successful courses, thirty-four were combined with Antuitrin S and thirteen with saline injections (column 12). There was no significant difference in the mean daily weight loss between the two groups (239.2 gm./day mean for the hormone-treated group, as compared with 234.3 gm./day mean for the saline group [Table II]). Of six unsuccessful patients, five took Antuitrin S and one saline.

Two patients had latent diabetes and one had overt diabetes. Three patients had hyperostosis frontalis interna. In two patients movements were limited by orthopedic conditions.

Patients reported that they felt hungry during the first few days of the diet; later hunger was not very strong, but a certain weakness took its place.

Most patients were constipated throughout the course of the diet. No other ill effects of the diet were reported.

COMMENTS

We assumed from the start that the success of Simeon's[1] regimen was in no way related to gonadotropin. This was clearly borne out by the results of the present series in which patients receiving 125 units of Antuitrin S showed the same daily weight loss as those

receiving saline. Injections, although given for psychologic reasons only, may well have served as an important psychotherapeutic agent, especially considering that the patient was reassured that they would curb his appetite, in determining the high percentage of courses completed. Obviously, neither the patient nor the family physician could be informed that the Antuitrin S was being given as a placebo. In the six patients who did not complete the forty-day course the diet was stopped by the family physician, since the supply of hormone ran out. One course was scheduled for and terminated in twenty days when the patient reached the desired weight (Table I).

The present series, as well as that reported by Simeon,[1] proves that obese patients can lead a normal life performing moderate work on 500 to 600 calories a day. Although none of the patients was engaged in heavy manual labor, many of the women engaged actively in the chores of farming in addition to household duties and their daily routine was far from an easy one.

As previously mentioned the only factor in the exclusion of patients from this series was that of limited intelligence. No patient with serious diseases presented himself for weight reduction. Since the completion of this series, however, one sixty-five year old man with arteriosclerotic heart disease and congestive failure completed the regimen successfully with no adverse effects. Our experience is still too limited to speak of medical counterindications.

Comparison of our results with those obtained by others is difficult since most authors do not take the time element into consideration. Most papers state the total weight loss in pounds or kilograms, whereas our results are most meaningfully expressed in weight loss of grams per day. We could not make use of the criteria of Trulson et al.[2] or other criteria found in the literature. It is well known, however, that the first month of dieting is most difficult and that the vast majority of patients abandon the diet before the first month is over. In a conference on therapy Melchionna[3] states that success is achieved in not more than 15 per cent of obese patients. In our regimen, when one course lasts forty days, forty-seven of fifty-three courses were completed successfully.

Recently, Feinstein, Dole and Schwartz[4] presented a table which summarized the experience of eight different groups in the ambulatory treatment of obesity. These series are representative of the usual dietary regimen,[5–12] and the duration of therapy, although usually not stated exactly, was prolonged. In spite of this it is apparent that the number of patients losing less than 10 pounds (4.5 kg.) varied from 35 to 71 per cent in the different series, while an additional 20 to 36 percent lost 10 to 19 pounds (4.5 to 8.6 kg.). All of our patients who completed the forty-day trial lost more than 10 pounds and the majority more than 19 pounds.

The patients reported by Feinstein et al.[4] were treated on a 900 calorie formula diet. Those who stayed on the diet for a month or more lost about 240 gm. daily during the first month, which is about the same as in our series. However, the daily weight loss in their series decreased progressively[6] and settled at about 130 gm. daily (2 pounds weekly), which is considerably less than our average. A major objection to the use of formula diet in treatment is that there is no attempt to re-educate the patients' eating habits.

We believe the following advantages inherent in the diet program proposed by Simeon[1] and prescribed for our patients to be responsible for its success:

(1) *Time limitation combined with high daily weight loss:* Most reducing diets contain 1,000 to 1,400 calories. Average daily weight loss is very small and sometimes two or more weeks pass before patients can appreciate even inconsiderable results. They perceive dieting as an indefinite process dragging on for months or years. Small wonder that most patients despair and abandon treatment. In prescribing the 550 calorie diet, a definite time limit of forty days is set. The results of weight loss are apparent after a few days. The vast majority of patients are willing to suffer forty days for the reward of losing the predicted and attainable amount of 20 pounds (9.5 kg.).

(2) *Food is prescribed, not calories:* It is our experience that the caloric conceptions of hungry, dieting patients are substantially different from the ones recorded on calorie charts.

Most patients who are allowed to substitute caloric equivalents in their diets do not weigh their food, nor do they know exactly its composition. The translation of calories into meals is done by broad approximations which can easily increase the caloric intake by 50 per cent or more. We find it advantageous, therefore, not to advise patients in terms of calories, but to prescribe meals in detail.

(3) *Two meals per day:* Patients were instructed to eat only twice daily, thus minimizing contact with food.

(4) *Unrestricted normal activity:* No hospitalization or restriction of normal activity is necessary, enabling all obese people, most of whom are housewives, to reduce.

CONCLUSIONS AND SUMMARY

The purpose of this paper was to present a method, attractive to the obese patient, of producing rapid weight reduction. We do not intend to discuss the complex problem of maintaining the reduced weight at this time. There is little doubt, however, that the proposed reducing program will substantially increase the number of patients reaching the stage at which maintenance of the new weight becomes the problem.

Forty-five ambulant patients started fifty-three forty-day courses of a 550 calorie diet, consisting of two meals prescribed in detail. For psychologic reasons, intramuscular injections of 0.25 ml. placebo were given daily. Forty-seven courses (89 per cent) were terminated successfully, with an average daily weight loss of 237 gm. (about 20 pounds in forty days). This series surpasses the results reported by other authors.

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Food Habits and Food Consumption of Jews from Cochin in Israel

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THE JEWISH population of Israel, now approaching two million, has come from over seventy countries. The new immigrants, differing in their social and cultural patterns, are in the process of merging with the "old settlers," those who have been living in the country since before 1948, the year of the establishment of the State of Israel. It is true that most of the old settlers themselves or their parents immigrated during the last two generations, mainly from Europe. But in the minds of many of the new immigrants, as well as in their own, they represent that element of the nation which is settled, stabilized and deep-rooted. This mutual attitude affects many facets of cultural life in Israel. Thus, the old settlers, although numerically a minority, are expected to "absorb" the new immigrants, both economically and culturally.

Naturally, many new foods and food habits have been introduced. Some "oriental foods" have been readily accepted and their use is now widespread among all ethnic groups. Many food habits, however, are preserved in specific ethnic communities and have not yet become popular with the general population. Since food habits often represent the emotional ties which link the new immigrant with his country of origin, they often tend to be preserved as far as possible in the new environment. This possibility is frequently limited in Israel. Economic factors, as well as the non-availability of certain foodstuffs, often frustrate this tendency of preserving food habits, especially in smaller ethnic groups. A new problem arises: how do new immigrants manage to obtain a satisfactory diet under these conditions, where the choice of food is limited and the consumer is compelled to use food to which he is not accustomed? This problem has been studied in one of the smallest ethnic groups of immigrants, which differs much in its food habits from those of the rest of the population, i.e., Jews from Cochin, south India.

ETHNIC AND SOCIAL BACKGROUND

The Jews from Cochin form a distinct ethnic group of the Jewish people. They are believed by some to be descendants of Jews exiled to Babylon by Nebuchadnezzar (586 B.C.). They themselves maintain that soon after the destruction of the Second Temple by the Romans (70 A.D.) ten thousand Jews escaped and landed on the Malabar coast.[1] There are indications that toward the end of the second century A.D. several thousand persecuted Jews from Yemen, Southern Arabia, emigrated to India. These early Jewish settlers probably intermingled with the Hindu natives and later, possibly with Portuguese, Dutch and British settlers.[2,3] Thus, they differ in their blood group distribution from other Jewish groups.[4] Their once large and flourishing community has been reduced by now to some 3,000 people. Previously, most of them lived in small towns and villages in Cochin and a few in Bombay. They have preserved their Jewish religious belief and their distinct cultural institutions, thus attempting

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to avoid assimilation. Driven by the Zionist ideal they prepared themselves for immigration to Israel after the establishment of the State in order to assist in the development of the country. In 1954 some 2,500 immigrated.

In their new homeland the Jews from Cochin started a different way of life. Most of them turned to development areas and joined in founding new villages. Former shopkeepers, small merchants and clerks became farmers. The life in Israel constitutes for them "a complete transformation of our life," as one of their leaders put it. Naturally, the process of adjustment is accompanied by many difficulties. Those who have settled in the hill regions of Galilee and Judea suffer from the unaccustomed hardship of the winter. They all had to learn Hebrew. Being in their present homeland a small minority again, although among co-nationals, they have had to adapt themselves to prevailing economic and social conditions as well as to a new cultural pattern, including different food habits.

Jews from Cochin living in two villages near Jerusalem were studied with the intention of obtaining information on the prevalence of the major types of heart disease, blood cholesterol levels and food intake. In this paper we report on food habits and food consumption, summarizing an inquiry which was conducted from October to November 1958.

The economic basis of most of the families is poultry farming and the growing of vegetables. Some of the adults are engaged as teachers, policemen or clerks of the village administration. The composition of the population sample studied is shown in Table I.

TABLE I

Composition of the Population Sample Studied

No. of households	82
No. of persons	462
Persons per household	5.6
Men:	
18–40 years old	63 (14%)
41–60 years old	33 (7%)
Over 60 years old	7 (2%)
Women:	
18–40 years old*	75 (16%)
41–60 years old	35 (8%)
Over 60 years old	10 (2%)
Infants, 0–12 months old	19 (4%)
Children, 1–12 years old	190 (41%)
Boys, 13–17 years old	9 (2%)
Girls, 13–17 years old	21 (4%)

* Sixteen pregnant women in the second half of pregnancy and eleven lactating women included.

METHODS

Daily record forms of food consumption were distributed to the families. All foods eaten and their quantities in ordinary household measures were recorded on these forms for each meal and each between-meal period. These quantities were carefully analysed by the nutritionist who supervised the recording daily, with the exception of Saturday. The records were checked for accuracy by observation in the kitchen and pantry. No correction could be made for table waste. Amounts of food provided to children in schools were calculated by dividing the weekly quantities delivered by the number of partaking children.

The detailed entries in the record forms were tabulated on calculation sheets in which food items and quantities were listed in a standardized manner. Nutritive values were calculated throughout from a specially prepared table which was generally derived from the tables of Albritton,[5] and Watt and Merrill.[6] The vitamin and mineral contents of vegetables and fruits were calculated according to the figures of Halevy, Koth and Guggenheim,[7] which are based on analyses of locally grown products. Representative samples of some unusual foods, for which no data are found in the tables, and of some foods of considerable dietary importance, which may differ in their composition in different countries, such as bread, some flour products and different kinds of cheese, were analysed in our laboratory.

Corrections were made for vitamin losses in cooking according to the data of Moore, Purdy, Gibbens, Hollinger and Goldsmith.[8]

The average daily consumption of nutrients by each family was compared with the Recommended Dietary Allowances.[9] Intake per unit was computed according to the procedure proposed by LeBovit and Stiebeling.[10] The

diet of any family was rated as "excellent" in a specific nutrient if the average daily intake of that nutrient per unit was 100 per cent or more of the Recommended Dietary Allowances; "good" if the average intake was 80 to 99 per cent of the allowance; "fair" if 60 to 79 per cent; "poor" if 50 to 59 per cent, and "very poor" if below 50 per cent. A mean dietary rating for each nutrient was then calculated by assigning the following numbers to each rating: excellent, 4; good, 3; fair, 2; poor, 1; and very poor, 0. These numbers were added together and an average obtained for each family diet which was designated as the mean dietary rating.

RESULTS

Food Habits in Cochin and in Israel

It has been very difficult, for obvious reasons, to study accurately the food habits of these people in India before they immigrated to Israel. It was, however, possible to obtain some information on the subject by interviewing housewives about their previous food habits. The daily menu in Cochin included rice, gram, fish, eggs, goat's milk, bananas, watermelon, tomatoes, onions, mangoes, coconuts, sugar and, on the Sabbath, raisin wine. Coconut oil was the main fat used. The following may be regarded as a typical daily menu: Breakfast: rice bread, gram, spiced vegetable salad and coffee; lunch: rice, eggs and fish, fried in tomato sauce with added lemon juice; four o'clock: coffee, cookies and fried sugared bananas; supper: fish in a piquant sauce and rice. Many families ate fish and rice three times a day. Fruits, such as mangoes and bananas, as well as coconut cakes were very popular in the afternoon. The pattern in Bombay was very similar. The staple foods were likewise rice and fish and the menu included potatoes, tomatoes, cauliflower, lemons, mangoes, bananas, ghee and sugar. However, in contrast to Cochin, wheat flour products were consumed too. At breakfast rice or wheaten bread was eaten with gram or potatoes in oil, onion and mustard. Lunch consisted mainly of rice and fish which was stewed in tomato sauce, and at supper leftovers were used from lunch as well as various vegetables. Fruits were consumed between meals. Wheat products other than bread, such as macaroni or semolina, were not widely used, and margarine, cow's milk, cheese and certain vegetables and fruits, such as carrots, beets or olives, were almost unknown.

TABLE II

Daily per Capita Food Consumption (in gm.)

Cereals:	
Bread	256
Other wheat products	98
Rice	60
Total	414
Fruits and vegetables:	
Potatoes	71
Tomatoes and tomatoe puree	84
Citrus (fruits and juices)	106
Bananas	32
Onions	55
Others	54
Total	402
Pulses	10
Nuts and seeds	5
Sugar and sweets	71
Margarine and edible oils	46
Meat, poultry, fish and eggs:	
Meat	2
Poultry	29
Fish	24
Eggs	55
Total	110
Milk and milk products:	
Milk	211
Cheese	8
Cream	11
Total	230
Alcoholic beverages:	
Beer	67
Wine	14
Brandy	4
Total	85

This pattern has changed considerably during the last few years since their arrival in Israel. Table II shows the daily average consumption of foods per capita.

The average daily menu contains considerable amounts of wheat products, and it includes also 60 gm. rice per person. It provides over 400 gm. potatoes, vegetables and fruits, mainly citrus fruits and juices, tomatoes and tomato puree, which is a very popular

TABLE III
Number and Per Cent of Families Using Certain Foods

Food	No.	Per cent
Cereals:		
Dark bread	76	93
White bread	78	96
Flour and flour products	82	100
Rice	82	100
Fruits and vegetables:		
Potatoes	82	100
Tomatoes and tomatoe puree	82	100
Onions	82	100
Citrus, fruits and juices	82	100
Bananas	57	70
Olives	51	62
Pulses	71	87
Nuts and seeds:		
Sunflower seeds	74	90
Coconut	20	24
Sugar and sweets:		
Sugar	82	100
Sweets	76	93
Margarine and edible oils:		
Margarine	82	100
Edible oils	82	100
Meat, poultry, fish and eggs:		
Meat	14	17
Poultry	61	74
Fish	73	89
Eggs	82	100
Milk and milk products:		
Milk	82	100
Cheese	65	79
Cream	50	61
Alcoholic beverages:		
Beer	71	87
Wine	77	94
Brandy	25	29

spice, onions and bananas. Among animal products it contains over 200 gm. milk and milk products, approximately one egg per day, 24 gm. fish and 29 gm. poultry but only 2 gm. of beef. As to consumption of milk, it should be noted that relatively small amounts are used in the households, the greater part being provided as milk powder to children in school. Similarly, consumption of cheese was found to be low. Another feature of the menu is a considerable consumption of beer, which was unknown in India, of wine, used mainly on the Sabbath, and of small amounts of brandy. Table III shows figures on the frequency of use of certain foodstuffs. It can be seen that most of the families studied now use bread and other wheat products, cheese and margarine, which were not used in India. Olives and certain fruits and vegetables, like carrots and beets, with which some of the newcomers were not acquainted in India, are also very popular. It should be noted that the consumption of dark bread (made from flour of 52 to 78 per cent extraction) amounts to 135 gm. per capita per day as against 121 gm. white bread (52 per cent extraction). This is in contrast to the strong preference of white bread shown by Jewish immigrants from other Oriental countries. One foodstuff appears to be used to a much larger degree by Jews from Cochin than by other Jewish inhabitants of Israel, i.e., rice. According to a dietary survey comprising over 1,000 families of the wage-earning urban population of Israel and conducted by Bavly[11] in 1951, daily consumption of rice averaged from 3.6 to 11.3 gm. according to different ethnic and economic strata. The last Food Balance Sheet of Israel[12] gives 12 gm. rice as available per capita per day in 1956–1957. According to these sources, average per capita consumption of eggs, olives and bananas was much lower than that found in our survey on Jews from Cochin, whereas that of meat and cheese was much higher.

If food selection of immigrant families reflects strong emotional ties with their native land, this holds even more so as far as spices are concerned. Jews from Cochin continue to use spices such as mustard, fenugreek (Trigonella foenumgraecum L.), black pepper (Piper nigrum L.), red pepper (Capsicum sp.), turmeric (Curcuma sp.), coriander (Coriander sativum L.) and cardamon (Elletaria cardamonum Mat.) to which they were accustomed in India. Most of them are not popular among communities of immigrants from Western countries, but they are characteristic of the food habits of Jews from Oriental countries.

Nutritional Value of Diet

Table IV presents figures on the nutritional value of the per capita consumption of nutrients and Table V, on the contribution of various food groups to the total supply of

TABLE IV

Daily Per Capita Consumption of Nutrients

Food Groups	Calories	Protein (gm.)	Calcium (mg.)	Iron (mg.)	Vitamin A (I.U.)	Thiamine (mg.)	Riboflavin (mg.)	Nicotinic Acid (mg.)	Ascorbic Acid (mg.)
Cereals	1,214	39.2	345	5.31	—	0.83	0.68	5.70	—
Fruits and vegetables	187	4.3	87	2.88	1595	0.21	0.09	1.75	59
Pulses	46	2.6	10	0.12	21	0.01	0.01	0.63	—
Nuts and seeds	21	0.8	3	0.07	—	0.01	0.01	0.49	—
Sugar and sweets	272	0.3	8	0.14	5	0.01	0.01	0.04	—
Fats and edible oils	385	—	—	—	780	—	—	—	—
Meat, poultry, fish and eggs	179	13.7	34	1.80	560	0.06	0.15	2.18	—
Milk and milk products	148	8.6	265	0.24	268	0.09	0.34	0.23	2
Alcoholic beverages	50	—	3	—	—	—	0.02	0.16	—
Total	2,502	69.5*	755	10.56	3229	1.22	1.31	11.18	61

* 22.3 gm. animal protein and 47.2 gm. vegetable protein.

nutrients. It can be seen that cereals provide about one-half of the total calories, protein, calcium, iron, riboflavin and nicotinic acid, and more than two-thirds of thiamine. About one-third of the total protein is derived from animal foods and two-thirds from vegetable sources. Carbohydrates provide 1,609 calories (64 per cent of total), protein 278 (11 per cent) and fats 615 (25 per cent) calories. It should be mentioned that 53.3 gm. fat (78 per cent of total) are derived from vegetable sources, mainly from soya oil and margarine, and 15.0 gm. (22 per cent) from animal foods.

The relatively high amounts of calcium and riboflavin contributed by cereals are partially the result of the enrichment of flour which is controlled by the government. At present all flour milled in this country is fortified with 30 gm. heat-processed soya meal, 2.5 mg. riboflavin and 2.5 gm. calcium carbonate per kg. Flour fortification contributes 0.54 mg. riboflavin and 267 mg. calcium to the daily diet of the population studied, or 41 and 35 per cent, respectively, of total consumption. Since margarine is enriched with 3,000 I.U. vitamin A and 30 I.U. vitamin D per 100 gm., this source provides 780 I.U. vitamin A per head or 25 per cent of total consumption.

Figures on consumption of nutrients per unit as well as dietary rating of households are pre-

TABLE V

Contribution of Various Food Groups to the Total Supply of Nutrients (in %)

Food Groups	Calories	Protein	Calcium	Iron	Vitamin A	Thiamine	Riboflavin	Nicotinic Acid	Ascorbic Acid
Cereals	49	56	46	52	—	68	52	51	—
Fruits and vegetables	8	7	12	27	49	17	7	16	97
Pulses	2	4	1	1	1			6	—
Nuts and seeds	1	1	—	—	—	2	2	4	—
Sugar and sweets	10	—	1	1	—			—	—
Fats and edible oils	15	—	—	—	24	—	—	—	—
Meat, poultry, fish and eggs	7	20	5	17	18	5	12	20	—
Milk and milk products	6	12	35	2	8	8	26	2	3
Alcoholic beverages	2	—	—	—	—	—	1	1	—
Total	100	100	100	100	100	100	100	100	100

TABLE VI
Consumption of Nutrients and Dietary Rating of Households

	Calories	Protein (gm.)	Calcium (mg.)	Iron (mg.)	Vitamin A (I.U.)	Thiamine (mg.)	Riboflavin (mg.)	Nicotinic Acid (mg.)	Ascorbic Acid (mg.)
Average consumption per capita	2,502	69.5	775	10.56	3,229	1.22	1.31	11.18	61
Consumption of households									
Mean per unit	3,518	84.6	631	12.98	3,885	1.79	1.59	16.68	76
Median per unit	3,518	80.5	592	12.45	3,843	1.74	1.58	17.01	72
25th percentile	3,114	70.2	524	10.58	3,100	1.51	1.30	12.91	51
75th percentile	4,191	100.1	784	15.00	4,940	2.07	1.89	20.30	93
Dietary Rating of Households (in %)									
Excellent	68	89	15	52	16	66	45	49	45
Good	26	8	24	36	30	26	34	28	25
Fair	5	2	48	12	32	7	17	20	12
Poor	1	1	11	0	10	1	3	2	11
Very poor	0	0	2	0	12	0	1	1	7

sented in Table VI. It can be seen that both mean and median consumption of calories, protein, iron, thiamine and nicotinic acid are above those of the Recommended Dietary Allowances, whereas those of vitamin A and calcium are appreciably lower. Figures for riboflavin and ascorbic acid are similar to the Recommended Dietary Allowances. Dietary rating of most households is excellent or good for all nutrients except vitamin A and calcium. Thirteen per cent of households have a poor or very poor rating for calcium, 22 per cent for vitamin A and 18 per cent for ascorbic acid.

Total dietary rating of 4 per cent of all households was excellent; good could be attributed to 65 per cent of all families, and fair to 23 per cent, whereas the diet of 7 per cent of all families was poor and of 1 per cent very poor. Mean dietary rating of all households was good.

COMMENTS

Generally, nutritional conditions of the community studied appear to be satisfactory in spite of the fact that most of the foods consumed in Israel by Jews from Cochin were unknown to them a few years ago or were used in limited quantities in their country of origin. The acceptance of wheat products as a staple food seems to be remarkable. The relatively high consumption of rice as well as the frequent use of bananas and certain spices, however, is reminiscent of food habits to which they had adhered in India and which have been preserved in their new homeland. The extremely low consumption of meat, which falls much below the Israeli average,[12] in contrast to a level of fish consumption which may appear rather high in an agricultural population, may also be characteristic of a community which immigrated from the sea shores of Malabar. The extensive use of poultry and eggs is understandable in a population subsisting mainly on poultry farming.

Calorie consumption was found to be rather high, which is appropriate in an agricultural and hard working community. However, it should be noted that our figures include table waste. Actual intake of calories as well as of other nutrients would appear to be somewhat lower.

Calcium and vitamin A were the nutrients consumed in the most inadequate amounts. In only 39 and 46 per cent of the families, respectively, was the consumption of these nutrients considered as good or excellent (Table II). It should be noted that the survey was performed at a time when fruits and vege-

tables were not plentiful. It is probable that the consumption of fruits and vegetables, which falls markedly below the Israeli annual average[12] would have been higher if the survey had been conducted at a different season, i. e., the summer. Consumption of carotene and ascorbic acid would probably have been somewhat higher at another time.

Calcium intake was found to be inadequate as a result of a relatively low consumption of milk and milk products. This is characteristic of the Israeli population[11] and of Jews from Oriental extraction more so than of Jews of European or American origin. Actually this is the main reason for calcium fortification of flour in Israel. But even this fortification, which provides a considerable part of total calcium intake, leaves consumption of calcium of 13 per cent of families in poor or very poor brackets. More extensive use of milk and milk products should be encouraged. Provision of milk and milk powder in schools and Mother and Child Welfare Stations represent an important step in this direction.

SUMMARY

A dietary survey has been conducted of eighty-two families of Jews from Cochin living in two agricultural settlements in Israel. The evidence presented shows that a considerable change of food habits has taken place, since these people immigrated to Israel. Most conspicuous is the acceptance of wheat products, replacing rice to a large extent as a staple food. The relatively high level of rice and fish consumption in the diet, the extremely low consumption of meat, as well as the use of certain spices, are characteristic of the dietary pattern of the community.

In spite of changing food habits, the general level of consumption of nutrients is satisfactory, although the intake of calcium, vitamin A and ascorbic acid is inadequate in 13 to 22 per cent of households, if judged accordingly to Recommended Dietary Allowances. Mean dietary rating of all households, however, is good.

Enrichment of flour with soya meal, calcium and riboflavin and of margarine with vitamins A and D significantly contributes to the supply of calcium, riboflavin and vitamin A of the community studied.

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Nutritional Evaluation of Flour Enrichment with Riboflavin in Israel

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In 1945 Braun, Bromberg and Brzezinski[1] reported that 190 (21 per cent) of 900 pregnant women belonging to the lower social brackets of the Jewish population of Jerusalem showed definite signs of ariboflavinosis. All patients manifested glossitis in various morphologic forms. Papillitis was observed in 70 per cent, atrophic glossitis in 25 per cent and ulcerative changes of the tongue with desquamation of the lingual mucosa in 5 per cent of the cases. In 90 per cent glossitis was accompanied by cheilosis or angular stomatitis. Excretion of riboflavin in the urine was very low, 0.095 mg./100 ml. urine as against 0.350 mg. in a series of middle class pregnant women. The specificity of the observed signs was also therapeutically proved.

Dietary studies conducted at the same time among the Jewish population of Palestine[2–5] led to the conclusion that the diet, especially of the lower income groups, was very low in riboflavin. After the establishment of the State of Israel in 1948, the government accepted the advice of nutrition experts to enrich all flour milled in Israel with riboflavin, and at present flour is fortified with 2.5 mg. riboflavin, 2.5 gm. calcium carbonate and 30 gm. heat-processed soya meal per kg. The premix, consisting of soya meal, riboflavin and calcium carbonate, is prepared in one central mill and distributed to the other mills of the country. Preparation of the premix as well as its proper addition to the flour is controlled by the government.

The study here reported represents a clinical and biochemical resurvey of a population of pregnant women belonging to similar low income groups as were studied in the 1940's, in order to evaluate the effect of flour enrichment with riboflavin. Results of a dietary survey on these women will be reported elsewhere.

MATERIAL AND METHODS

Social Background of the Population Studied

The population studied in the 1940's represented a particular ethnic, social and economic group in an urban area which has remained almost unchanged and uninfluenced by the great changes that have taken place in Israel during the last eleven years. The present study was conducted on women living in the same quarters of Jerusalem and registered at the same Antenatal Care Stations, as in the previous study. The women were chosen by public health nurses who were acquainted with the economic and social conditions of the families. Only those women who lived under poor economic conditions and who had resided in Israel for at least seven years were included in our study. The low economic status of the population was reflected in the poor and crowded living conditions. More than 50 per cent of the women lived among families with three or more persons per room. The corresponding percentage of the total population of Jerusalem is 26.7.[6] Forty per cent of

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the women already had three or more living children.

The Group Studied

The group studied was comprised of about 400 women during the latter half of pregnancy or early lactation (one to three months after delivery). Most of them were examined twice or more, one-third of them only once. Thus, the total number of examinations approached 800 (Table I). Women taking riboflavin-containing preparations were excluded from the study.

TABLE I

Number of Women Examined

No. of Examinations	Clinical Examination		Urine Examination	
	No. of Women	No. of Examinations	No. of Women	No. of Samples
One	130	130	138	138
Two	189	378	159	318
Three	79	237	85	255
Four	14	56	13	52
Five	1	5	2	10
Total	413	806	397	773

Clinical and Biochemical Assessment

The clinical examination was restricted to a thorough inspection of the face, lips and tongue, since we intended to adhere to the same procedure which had been adopted in the previous survey. Similar principles held for the examination of riboflavin in the urine. As in the previous survey, urine specimens were obtained from the women on their visits to the station. Since single samples examined for riboflavin only provide a poor estimate of the average excretion,[7] the excretion per gram of creatinine was determined in order to obtain a higher degree of accuracy in the assessment of nutritional status with regard to riboflavin.[8] Riboflavin was determined fluorometrically[8] and creatinine according to the method of Taussky.[9]

RESULTS

Clinical Examinations

No case of typical ariboflavinosis with the characteristic symptoms of dyssebacea, cheilosis and glossitis was detected. Angular sto-

TABLE II

Number of Women Showing Papillitis and Angular Stomatitis in Relation to Living Conditions and Number of Living Children

	No. of Women	Per cent of Total	No. of Women Showing Signs of		
			Papillitis	Angular Stomatitis	Both Papillitis and Angular Stomatitis
No. of persons per room:					
0–2.9	192	46	2	1	—
3.0–5.9	152	37	1	8	1
6.0–8.9	54	13	—	3	—
9.0 and more	15	4	—	2	—
No. of living children:					
0	94	23	1	6	—
1–2	156	37	—	7	1
3–4	95	23	2	4	—
5–6	40	10	—	2	—
7 and more	28	7	—	3	—
Total	413	100	3	22	1

matitis was found in twenty-two cases and hypertrophic or atrophic papillae (papillitis) in three cases; one woman exhibited both symptoms (Tables II and III). Angular

TABLE III

Frequency of Papillitis and Angular Stomatitis by Months of Pregnancy and Early Lactation

	No. of Examinations	No. of Patients with		
		Papillitis	Angular Stomatitis	Both Papillitis and Angular Stomatitis
Month of pregnancy:				
IV	23	—	—	—
V	139	—	9	—
VI	141	—	7	—
VII	124	—	4	—
VIII	117	—	4	—
IX	78	1	6	1
Early lactation	178	2	1	—
Total	800	3	31	1

stomatitis, however, is not pathognomonic of riboflavin deficiency as was once thought. Furthermore, hyper- and atrophic papillae of the tongue may be attributed to dietary lack of one or another of the B vitamins.[10] The signs which were observed in a small number of cases are, therefore, of questionable value in the diagnosis of ariboflavinosis, when they are not accompanied by more typical symptoms, as were seen in the previous survey. There appeared to be no correlation between the frequency of these signs and the living conditions, the number of living children or the month of pregnancy (Tables II and III). In the previous survey, however, the largest number of cases occurred toward the last trimester of pregnancy. It may, therefore, be concluded that clear-cut clinical riboflavin deficiency essentially does not exist in the group studied.

Biochemical Examinations

These results were corroborated by those of riboflavin excretion studies (Table IV). Both mean and median values of riboflavin excretion per 100 ml. of urine were much higher in each month of pregnancy or in early lactation than the average of ariboflavinotic women in the previous study (9.5 μg./100 ml.) and were similar to the values obtained in normal control subjects (35 μg./100 ml.). Moreover, in much less than 10 per cent of the 773 examinations were values below 9.5 μg./100 ml. of urine. Mean and median riboflavin excretion per gram of creatinine were 0.47 and 0.43 mg., respectively. The riboflavin concentration of more than three-quarters of the samples was "high," that of 22 per cent "acceptable;" in only three samples (0.4 per cent) was the excretion "low." It is noteworthy that riboflavin excretion during early lactation appears to be higher than in pregnancy.

For purpose of comparison, twenty-four-hour excretion of riboflavin was examined in nineteen healthy male and female students and laboratory workers presumably subsisting on a satisfactory diet. Mean excretion was 511 (standard error: 61) μg./twenty-four hours or 53 (S.E.: 5.34) μg./100 ml. of urine or 0.44 (S.E.: 0.051) mg. per gram of creatinine.

COMMENTS

Our study shows that the ariboflavinosis which was widespread among pregnant women of the lower income classes in Jerusalem during the 1940's has now practically disappeared. It may be asked what role is played by flour enrichment with riboflavin in this remarkable improvement and what role by other factors, such as improvement of the economic situation, nutritional education and change of food habits, which may lead also to higher riboflavin intake. Obviously, one cannot answer this question with certainty. But since the population and the quarters studied remained stable from the sociologic point of view, and since the individuals studied belong to those lower income groups who cannot afford a diet rich in eggs, meat and milk products, it would appear reasonable to believe that the flour enrichment program was important in the improvement noted. Moreover, preliminary results of our dietary survey among these women (which we hope to publish

TABLE IV

Mean Values and Percentiles for Excretion of Riboflavin by Months of Pregnancy and Early Lactation

	Month of Pregnancy							
	IV (48) *	V (130)	VI (112)	VII (120)	VIII (116)	IX (82)	Early Lactation (165)	Total (773)
Riboflavin (μg./100 ml. urine)								
Mean	47	41	40	31	37	36	57	41
10th percentile	9	12	13	11	13	12	18	13
25th percentile	21	21	23	19	19	21	29	22
50th percentile	41	35	33	28	30	31	49	34
75th percentile	63	53	54	44	54	48	69	54
90th percentile	87	96	68	61	67	69	93	78
Riboflavin (mg./gm. creatinine)								
Mean	0.49	0.46	0.43	0.40	0.41	0.46	0.55	0.47
10th percentile	0.17	0.19	0.18	0.16	0.23	0.25	0.26	0.20
25th percentile	0.26	0.28	0.26	0.26	0.29	0.30	0.33	0.28
50th percentile	0.40	0.41	0.39	0.34	0.36	0.45	0.56	0.43
75th percentile	0.56	0.65	0.56	0.41	0.50	0.58	0.75	0.61
90th percentile	0.82	0.83	0.76	0.65	0.70	0.74	0.94	0.82
Results								
"Low" (less than 0.08 mg./gm.), per cent	—	0.8	0.9	—	0.9	—	—	0.4
"Acceptable" (0.08–0.27 mg./gm.), per cent	30.2	24.1	28.8	32.5	21.2	21.7	10.4	22.3
"High" (more than 0.27 mg./gm.), per cent	69.8	75.1	70.3	67.5	77.9	68.3	89.6	77.3

* Figures in parentheses represent number of samples.

extensively in the near future) show that about 35 per cent of the total riboflavin intake is derived from riboflavin added to the flour.

Riboflavin content was determined in fifty-seven samples of flour during the period of our study (October 1957 to January 1959). Twenty-nine samples were of "standard flour" (52 to 78 per cent extraction) used for "standard bread" and twenty-eight samples were of "white flour" (52 per cent extraction) used for white bread, rolls, cakes and macaroni. They contained 4.02 (standard error: 0.25) and 2.95 (0.19) mg. of riboflavin per kilogram.

Flour contributes significantly to the level of nutrition in Israel. According to the last Food Balance Sheet[11] covering the period from October 1956 to September 1957, the average quantity of cereals available amounted to 380 gm./person/day. Cereals, mainly wheat products, contributed 47 per cent of the calories, 51 per cent of the protein and 34 per cent of the riboflavin in the diet. Since flour is an inexpensive source of calories, its place in the diet of the lower income groups is of great importance. A recent survey conducted on 100 pregnant women living in development areas of Israel* has shown that 42 per cent of their total riboflavin intake is derived from flour products and 36 per cent from the riboflavin added to flour. Another

* Guggenheim, K. Unpublished results.

dietary survey performed in two agricultural settlements and comprising eighty-two households[12] has demonstrated that 0.68 mg. or 52 per cent of the average riboflavin consumption of 1.31 mg. per person is derived from cereals and 0.54 mg. or 41 per cent from flour fortification. Riboflavin intake from all foods available to the population amounted in 1956 to 1957 to 1.48 mg. per person.[11] In our study on nineteen adults, on the average 511 μg. of riboflavin were excreted per twenty-four hours. Adults subsisting for prolonged periods on diets providing 1.6 and 2.15 mg. riboflavin per day, respectively, have been shown to excrete 434 and 715 μg., respectively, per day.[13] It appears to follow from these figures that the persons studied by us may have consumed 1.5 to 1.8 mg. of riboflavin per day, the amount recommended by the National Research Council for male and female adults, respectively.[14]

The effect of flour enrichment on the health of the population was studied by Figueroa and co-workers.[15] These authors were impressed by the lack of avitaminosis among alcoholics examined in Chicago from June 1948 to July 1949, in contrast to its high incidence at the same place and in Boston in 1938 and 1941. A survey of the living conditions, food and alcohol consumption of the alcoholics showed no appreciable change between 1938 and 1948, the only factor being the enrichment of bread and cereals which started in Chicago in 1940 to 1941.

The principal study designed to evaluate the effect of flour enrichment on the health of a community was conducted in Newfoundland. At the time the study was begun in 1945 an extensive clinical and laboratory survey led to the conclusion that nutritional disease was widespread.[16,17] A resurvey[18] three years later, after enforced enrichment of wheat flour, showed considerable improvement in nutritional status. However, the authors of the study indicated a general improvement in economic status that had also occurrred during the study period. Although this factor of economic improvement cannot completely be excluded, it plays only a minor role in our study, since the population examined was selected from the lower social strata. It may, therefore, be concluded that flour enrichment with riboflavin has led to an improvement of nutrition and public health in Israel.

SUMMARY

A clinical and biochemical survey of 400 women during the latter half of pregnancy and early lactation, and belonging to the lower income strata of the Jewish population of Jerusalem, was performed in order to study their status of nutrition with regard to riboflavin. Clinically, no certain case of ariboflavinosis was found. Riboflavin examinations of 773 urine samples of these women showed "high" excretion in 77.3 per cent; "acceptable" excretion in 22.3 per cent, and "low" values in 0.4 per cent. In comparison to a similar survey conducted during the 1940's among pregnant women of similar social background, and living in the same quarters of Jerusalem, a considerable improvement has taken place. This is attributed mainly to the enrichment of flour with riboflavin.

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A Dietary Study of the Pima Indian

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DESPITE the popular conceptions of the high prevalence of multiple dietary deficiencies among certain Indian groups, there are few nutrition studies to support these ideas. As late as 1954, Kraus stated, "scientifically conducted surveys of nutritional status among Indian populations of the Southwest have been almost totally lacking."[1]

Recently completed nutritional studies among Navaho Indians living in northern Arizona have shown little evidence of any nutritional disorders.[2] The difference in terrain, climatic conditions, availability of foods and the lack of cultural bonds between varying Indian groups have given rise to marked variations in dietary pattern; and no conclusion can be drawn about dietary habits of other Indian tribes from the study of the Navaho.

A recent two-year survey[3] of the disease pattern of the Pima Indian of southern Arizona has shown a low incidence of arteriosclerotic heart disease and peptic ulcer, while the incidence of gallbladder disease is high. In a population of 4,668,[5] which has completely accepted modern medicine making reporting fairly valid, only three cases of myocardial infarction were found; none of angina pectoris; none of peptic ulcer but there were 125 cases of gallbladder disease during a two-year period.

This disease pattern, especially the low incidence of arteriosclerotic heart disease among the Pima Indian, has indicated a need for a study of their diet to note any factor which may influence the incidence of disease. The diet of this particular Indian tribe has never been investigated.

Kraus states that the diet of the Papago Indians, a southern neighbor of the Pima Indians, includes tortillas, beans, potatoes, coffee and some meat.[1] Vavick and associates[4] have estimated that the Papagos have a low intake of animal proteins as compared to American standards. In view of these meager observations, I elected to survey the dietary habits of the Pima Indians during a two-year assignment as physician in the Public Health Service Indian hospital in Sacaton, Arizona.

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BACKGROUND

The Pima Indian reservation is located south of Phoenix, Arizona, and covers 372,072 acres of desert and irrigated farmland. The population is 4,668[5] although Kraus estimates that the population is closer to 10,000. Ninety-eight per cent of the Pimas speak English.[1] They live in small, but sturdy one or two room houses built of adobe brick, or in less sturdy prefabricated houses bought cheaply after World War II from nearby Japanese relocation centers. Only 2 per cent of the homes have plumbing, therefore, water must be hauled varying distances from government-built wells in larger reservations. About one-half of the homes have electricity. The people are primarily farmers, raising cotton and barley, but due to the unavailability of water, only a small portion of the land is irrigated, and the major portion of their earnings is from seasonal work in off-reservation cotton fields. Very little food is raised for home consumption, and there are no cattle that can be slaughtered for meat similar to the custom of the Navahos.

Most of the Pimas' food is bought at various trading posts on the reservation. These posts stock most of the foods found in any present-day grocery. Shopping trips, however, are made rather infrequently by those people who live in outlying areas, and even in urban areas very few homes have refrigerators or ice boxes

to preserve perishable foods in the hot climate. This greatly limits the consumption of fresh milk, meat, fresh fruits and vegetables, and non-perishable foods constitute the bulk of the purchases.

There are no accurate figures available on the average income per family, but it is very low compared to American standards.

PLAN OF STUDY

This study describes the dietary pattern of fifty-one adults admitted at random to the U. S. Public Health Service Indian Hospital at Sacaton, Arizona. This hospital serves the entire Pima reservation and the northern part of the Papago reservation.* Forty-two of these patients lived on the reservation while nine lived immediately adjacent to the reservation in Indian camps established for those who work in off-reservation cotton fields.

Dietary histories were obtained by the recall method so that a consistent pattern was followed. Each person was asked what he usually ate for each meal, the size of the portion and the frequency with which the item was included in the diet. This was followed by a series of direct questions about foods usually included in the diet which he may have forgotten. The amount of lard used (the only source of fat in the diet) was estimated according to the amount and frequency with which lard was purchased and the number of portions into which it was divided. With this information, the average daily intake of lard per person was calculated, in order to quantitate the fat consumption more accurately. The average daily portion of other foods was obtained by adding the number of portions of an item consumed per day and dividing by the number of patients in the study. Portion sizes were estimated from intake by the patients studied and was the only method by which food intake could be quantitated.

Accurate measurements of food consumed in the Indian home cannot be accurately studied at the present time because cultural differences preclude invasion of the Indian homes for such a study.

Serum cholesterol was determined on a fasting blood specimen drawn from thirty-nine participants in the study. Cholesterol determinations were made by means of the Lieberman-Burchard reaction.

Although fifty-one patients constitute a small sample, the simplicity of the diet and the daily repetition are such that this small sample gives a generally accurate picture of the Pima diet.

FINDINGS

Beans, which are eaten at least twice daily by all members of the family, are the basic food of the Pima Indian. The type of bean varies—pinto, kidney, blackeyed or lima beans being used alternatively. They are cooked with the addition of about 1 teaspoonful of lard per serving, and are usually prepared in sufficient quantities so that they may be reheated or refried for the evening meal.

Tortillas are home-made from white flour, salt, soda and water—using nine cups of white flour and one-half cup of lard for approximately twenty 7-inch tortillas. The flour is almost exclusively of the non-enriched variety, and because it has a higher gluten content than enriched flour, it "makes better tortillas." Little enriched flour is sold at the trading posts. Popovers, a type of fried tortilla, are made of the same ingredients as tortillas except that baking powder is added and the dough is then fried in lard. Lard, bought at the trading posts, is used almost exclusively, while butter and vegetable shortening are rarely used.

Another popular item on the daily menu (Table I) is chili peppers of various types, which are eaten in large quantities with other foods during each meal. Lettuce, tomatoes, onions and squash are the most commonly used vegetables. Stew meat and hamburger are the most popular types of meat, although steak, luncheon meat and pork are also popular. Stews are usually plain, using only potatoes and onions, while chili stews are reserved for special occasions. Fruit consumption varies with the seasons. During winter and spring, citrus fruits are usually obtained locally at a

* I worked for two years among the Pimas, as a physician, and my personal acquaintance with the people and their habits was a great help in obtaining more accurate information.

TABLE I
Basic Meal Pattern of the Pima Indian

Breakfast	Lunch	Supper
Oatmeal	Beans	Beans
1 to 2 eggs	1 to 2 tortillas	1 to 2 tortillas
1 to 2 tortillas	1 to 2 chili peppers	1 to 2 chili peppers
1 to 2 chili peppers	Fried potatoes 2 to 3 times/ week	Fried potatoes 2 to 3 times/ week
Occasional beans or fried potatoes	Coffee	Meat 1 time/week
Coffee		Coffee

low price from off-reservation fruit orchards. During the summer months, melons and watermelons are frequently consumed. During autumn and early winter when no fruit is available, more baking is done and cake is eaten in its place. This cake, mostly of the plain variety, is either purchased at the trading post or baked at home (Table II).

Longhorn cheese and cottage cheese are occasionally eaten, but their use is not extensive.

Coffee and tea are the most popular beverages during the meal, but a large amount of soft drinks of all types is consumed between meals. Since the use of soft drinks is greatly dependent on the weather and their use cannot be quantitated, they were omitted from this study. Milk used is entirely of the canned evaporated type.

In this study no attempt was made to investigate the diet of infants. The general impression is that a large majority of infants are breast-fed. Formulas use evaporated milk

TABLE II
Frequency Various Foods are Included in the Diet Each Week (Figures in percentage)

Foods	Breakfast				Lunch				Supper				Less than Once
	Daily	4–5 Times	2–3 Times	Once	Daily	4–5 Times	2–3 Times	Once	Daily	4–5 Times	2–3 Times	Once	
Beans	18	8	26	4	72	12	10	2	82	14	2	2	
Tortillas	68	6	8	2	80	4	8	0	82	10	2	0	
Bread	18	8	14	4	4	4	6	2	6	0	12	4	
Popovers	0	2	8	12	0	0	12	16	0	0	12	10	
Potatoes	14	6	40	8	4	2	34	10	14	2	32	8	
Vegetables	2	0	2	6	4	4	14	18	6	4	20	20	
Salads	0	0	0	0	6	0	2	2	2	0	6	6	
Cereals	34	6	34	10	0	0	0	0	0	0	0	0	
Meat	0	0	2	12	8	6	22	32	4	2	24	24	10
Eggs	32	10	48	10	0	0	2	0	0	0	0	0	
Cheese	0	0	0	0	2	0	16	28	2	2	12	20	
Bacon	10	2	28	10	0	0	0	0	0	0	0	0	
Soups	0	0	0	2	0	0	4	0	2	2	0	0	
Chili peppers	54	4	4	0	56	0	8	2	56	0	0	0	
Cakes (including pancakes)	0	4	8	20	0	0	26	30	2	0	10	12	
Fruits	4	2	4	6	4	4	10	20	4	0	10	16	
Coffee	86	2	4	0	54	2	2	0	48	0	0	0	
Tea	0	0	0	0	30	0	0	0	20	0	0	0	
Milk (including with cereal)	36	2	10	0	4	4	4	0	4	2	0	0	

almost exclusively. As the infant grows older he is fed some of the oatmeal used by the family, and beans, tortillas and other family foods are started soon thereafter. Proprietary baby food, although available at the trading post, is seldom used.

DIETARY ANALYSIS

The average Pima Indian consumes approximately 2,800 calories daily (Table III), which is approximately the caloric intake recommended by the National Research Council.[8] The protein intake of 105.2 gm. is above the normal recommended average of 55 to 65 gm. However, 84 per cent of the protein originates from plant sources (Table III).

Fats furnish about 24 per cent of the caloric intake. This is within the usual recommendation of 20 to 25 per cent, but below the 40 per cent figure supposedly consumed in the over-all American diet. About 87 per cent of the fat is of animal origin and is almost completely of the saturated variety.

The mineral content of the diet shows it to be above the recommended daily intake for iron, due mainly to the large consumption of

TABLE III

Analysis of Foods Eaten in Pima Diet[6]

Food	Unit	Average Daily Portion	Calories (gm.)	Carbohydrate (gm.)	Protein (gm.)	Fat (gm.)	Cholesterol[7] (mg.)	Calcium (mg.)	Iron (mg.)	Vitamin A (I.U.)	Thiamine (mg.)	Riboflavin (mg.)	Niacin (mg.)	Ascorbic Acid (as.)
Beans*	Bowl (1½ cups)	2.37	820	150	52.0	3.5	—	360	17.4	0	0.43	0.43	7.1	0
Tortillas*	7 inches each	4.69	855	180	24.8	2.3	—	39	4.9	—	0.14	0.09	2.3	—
Bread, white	1 slice	0.69	44	8.3	1.3	0.5	—	10	0.3	—	0.04	0.03	0.3	—
Popover*	7 inches each	0.23	47	8.9	1.2	0.1	—	2	0.1	—	0.01	0.01	0.1	—
Cereal) (oat.)	1 cup	0.53	78	13.8	2.9	1.5	—	11	0.9	—	0.12	0.03	0.2	—
Cake (cup.)	1 cupcake	0.18	29	5.6	0.5	0.6	—	10		9	—	0.01		—
Potatoes	2 med.	0.66	128	30.0	2.6	—	—	17	1.0	26	0.07	0.03	0.9	11
Vegetables	1 cup	0.30	14	2.8	0.7	0.2	—	8	0.4	600	0.04	0.02	0.5	10
Salad (lettuce and tomato)	1 cup	0.13	5	1.0	0.3	0.1	—	3.5	0.1	214	0.01	0.01	0.1	—
Chili peppers	1 pepper	3.79	16	3.6	0.8	0.1	—	7	0.3	400	0.02	0.04	0.2	77†
Meat (chuck)	3 oz. serving	0.32	85	—	7.3	6.1	48	3	0.8	—	0.01	0.05	1.1	—
Eggs	1 medium	0.81	67	0.2	5.0	4.5	275	21	1.0	440	0.03	0.1	—	—
Cheese (cheddar)	1 oz.	0.16	17	0.1	1.1	1.4	5	33	0.1	64	—	0.1	—	—
Bacon	1 strip	0.41	24	—	0.8	1.8	3.3	1	0.1	—	0.02	0.01	0.2	—
Coffee with milk	1 cup	2.10	21	2.1	1.0	1.0	—	42	—	50	0.1	0.02	0.1	—
Tea with sugar	1 cup	0.39	10	2.7	—	—	—	—	—	—	—	—	—	—
Milk	1 cup	0.20	33	2.2	1.6	2.0	6.6	63		78	0.02	0.05	0.1	—
Fruit	1 medium orange	0.39	27	6.8	0.5	0.1	—	20	0.2	113		0.02	0.2	30
Biscuit	One	0.10	13	2.0	0.4	0.3	—	8	—	—	—	—	—	—
Syrup	1 tbsp.	0.08	4	1.1	—	—	—	—	—	—	—	—	—	—
Macaroni	1 cup	0.02	4	0.8	0.1	—	—	—	—	—	—	—	—	—
Soup (vegetable)	1 cup	0.05	4	0.7	0.2	0.1	—	2	—	—	—	—	—	—
Juice	1 cup	0.11	10	2.5	0.1	—	—	2	—	2	0.01	—	0.1	11
Lard		47.5	426	—	—	47.5	52	—	—	—	—	—	—	—
Total average daily intake			2781	425.2	105.2	74.2	389.9	694	24.6	1996	1.07	0.96	13.5	140†
Recommended daily intake by National Research Council[8]			2100–2900		65.0			1000	12.0	5000	1.0	1.4	10–16	70

* Lard used in preparation is included in lard column.

† Probably much less during winter months, due to ingestion of dried, canned or cooked chili peppers.

beans, but low in calcium. The diet is also low in vitamin A, furnishing approximately 2,000 I.U. The recommended daily allowance of 5,000 I.U. is approximately double the minimum requirement of 2,500 I.U.[9] The main sources of vitamin A in the diet are vegetables, eggs and chili peppers. The vegetable source of vitamin A is, however, variable depending on the type of vegetable consumed. Since vegetables and salads are mainly consumed on weekends, the vitamin A intake is at best low and sporadic.

Thiamin and niacin intake is adequate and above the recommended daily allowances of the National Research Council. However, the riboflavin intake of 0.96 mg. is below the recommended allowance of 1.4 mg. This is mainly due to the general use of non-enriched flour.

Ascorbic acid intake is high, but very variable depending on the season. Fresh chili peppers and citrus fruits, the main source of ascorbic acid are eaten only in summer while dried, cooked or canned chili peppers whose ascorbic acid is destroyed is eaten during the rest of the year.

The serum cholesterol concentration of the thirty-nine patients tested showed an average of 205 mg. per 100 ml. with a standard deviation of ±65.3. No attempt was made to break this figure down according to age and sex since the sampling is too small to be statistically significant, but most subjects were between the ages of twenty-five and fifty. This measurement is in accord with the cholesterol studies in normal healthy men by Keys[10] and falls into a range judged to be normal in this country.

COMMENTS

On the basis of this study, the Pima diet fulfills the standards recommended by the National Research Council except for an inadequate intake of calcium, vitamin A and riboflavin. The low level of consumption of carotene-containing foods is similar to findings among the Navaho where serum carotene measurements were low.[2] No evidence, however, of clinical vitamin A deficiency has been seen among the Navaho, and we have not seen any overt manifestation of vitamin deficiency among the Pima.

Although the protein intake is more than adequate due to the large consumption of beans, only 16 per cent of the protein is of animal origin, supporting the original impression of Vavick.[4] Its significance as far as the health of the Pima Indian is concerned can only be surmised at the present time.

It is of interest that with a comparatively low intake of fat, even though the fat is of a saturated type, the Pimas have an extremely low incidence of coronary atherosclerosis.[3] Keys,[10] who has shown a relationship between the percentage of calories consumed as fat and the incidence of "degenerative heart disease" among various population groups, points out that certain groups in Japan and Italy with low fat intakes also have a low incidence of coronary disease. The findings among the Pima Indians is consistent with Keys' observations among other ethnic groups.

Since the pathogenesis of the formation of gallstones has not been clearly elucidated, it cannot be said at this time that the Pima diet has any influence on the high incidence of cholelithiasis. However, the high rate of consumption of chili peppers, beans, and of fried foods which stimulate the production of cholecystokinin may do much to aggravate any existing chronic cholecystitis.

SUMMARY

The Pima Indians are a southern Arizona tribe which has readily acclimatized itself to Western civilization through fairly close proximity to off-reservation urban communities. Their food is bought in trading posts, but it is mostly non-perishable foods that are bought because of long distances traveled and lack of facilities for storage of perishable foods.

A dietary history of fifty-one Pima Indians shows the diet to consist mainly of beans, tortillas, chili peppers and coffee, while oatmeal and eggs are occasionally eaten for breakfast. Meat and vegetables are eaten only once or twice a week.

An analysis of their diet indicates that it fulfills the standards set by the Food and Nutrition Board of the National Research

Council, except that only 16 per cent of the protein consumed is of animal origin, and the intake of calcium, vitamin A and riboflavin is insufficient. No overt evidence of vitamin deficiency has been observed. Twenty-four per cent of the caloric intake is provided by fat which is completely of the saturated variety in the form of lard.

The average serum cholesterol level of 206 ± 65 mg. per cent in thirty-nine patients is within normal range.

The finding of a relatively low fat diet in relation to the low incidence of degenerative heart disease may be consistent with the reported findings in other population groups, except that the type of fat consumed is all of the saturated type.

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Appraisal of Nutrition in Haiti

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THIS study was organized in order to provide a background of information necessary to advise the Haitian Department of Public Health in instituting an effective nutrition program. It also afforded an opportunity to study the problems of conducting a comprehensive field nutritional survey and to extend and adapt to a civilian population the nutritional survey methods (*Manual for Nutrition Surveys*, May 1957, U.S. Government Printing Office, Washington, D.C.) developed by the Interdepartmental Committee on Nutrition for National Defense (ICNND).

Haiti seemed a desirable location for such a study since the findings should be not only of international scientific interest, but also the observations and practical recommendations could be used by the Haitian government to formulate programs for improvement of the nutritional status of their people.

Haiti consists of a coastal plain, a central plateau and several fertile valleys between rugged mountains of from about 5,000 to 9,000 feet elevation. The country is made up of five districts. The coastal plain is more important agriculturally in the northwest and northern districts. The central plateau is contained in the Artibonite district The Cul de Sac and the largest city, (225,000) Port-au-Prince, are in the western district, and the coastal plain and valleys are in the isolated southern peninsula.

The study was designed to sample as many of the various Haitian environments as possible. Therefore, the nutritional study covered the people of the coastal plain in the villages of Limbe, Limonade, Trou du Nord in the northern district. The people of the Artibonite valley were studied in the villages of Mirebalais, Deschapelles, and Pont de l'Estere; those of the Cul de Sac in the villages of Croix des Bouquets and Carrefour, and of the mountainous areas in St. Raphael in the north, Gros Morne in the northwest and Furcy in the south. The urban population was sampled in the three principal cities of Port-au-Prince, Cap Haitien and Gonaives. The towns of La Boule, Petionville and Kenscoff are hillside suburban areas near Port-au-Prince. They represent a relatively well-to-do population group.

In the time available it was not possible to visit the southwestern cities of Cayes, Jacmel and Jeremie. No information was obtained from the rather isolated southern peninsula because of transportation difficulties during the rainy season in which the survey was conducted.

The survey included 3,113 detailed physical examinations, and analyses of 454 specimens of blood and urine. These procedures were essentially as described in the Manual of the ICNND. The number examined in the various locations is given in Table I. Dietary histories were taken from 163 families and detailed observations made on farm crops, food on sale in markets, and food processing

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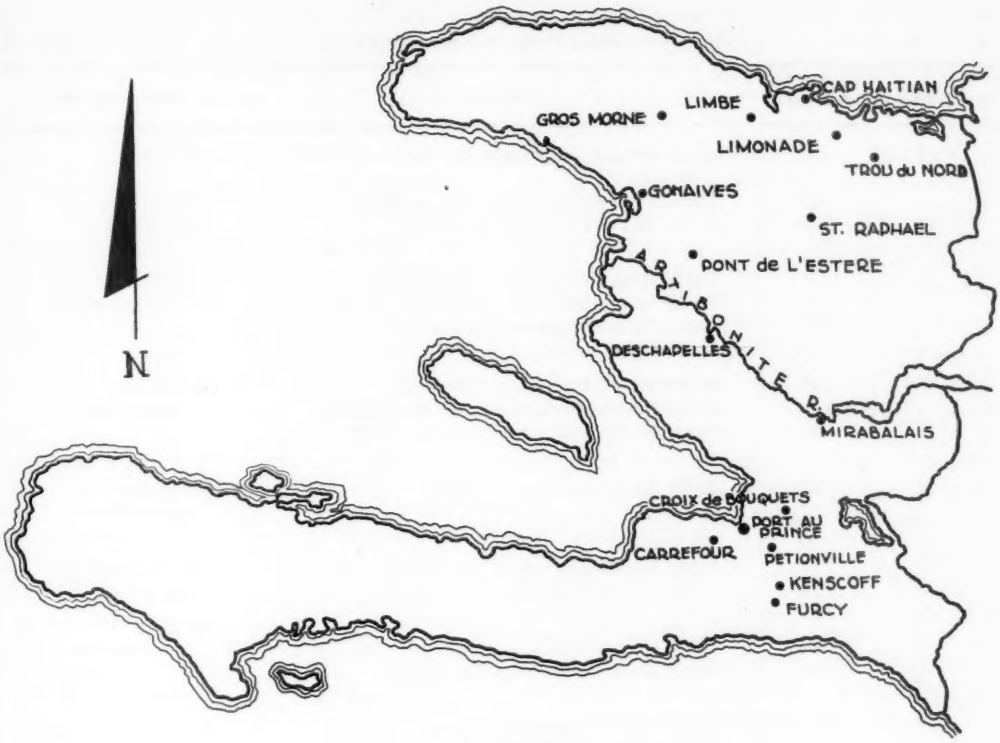
* With the assistance of Miss Lucienne Gemeau, FAO Nutrition Consultant, Miss Paulette Debrosse, Miss Germaine Désir and Miss Cecile Jean, Nurses; Mr. Jean Foucault of the Faculté de Medecine et Pharmacie; Mr. Ferdinand Vital, Laboratory Technician; Miss Marie Jose Frederique, Home Demonstration Agent, and Miss Marie Francoise Berger, United Nations trilingual secretary who gave invaluable help as interpreter of English, French and Creole.



Map of Haiti

plants. The findings are discussed in the appropriate sections of this report. The field work was carried out during the month of June 1958.

FOOD AND AGRICULTURE IN HAITI*

The agricultural situation in Haiti was reviewed in some detail by a United Nations Mission (Mission to Haiti, Report of the United Nations Mission of Technical Assistance to the Republic of Haiti, Lake Success, New York, 1949) and by M. A. Holly ("Agriculture in Haiti," Vantage Press, Inc., New York, 1955). Attention is also directed to "Making a Living in the Marbial Valley," by Alfred Metraux, Unesco, 19 Avenue Kleber, Paris, December 7, 1951, Unesco/ED/occ/10. In the five to ten years since these reports were prepared, the economy of Haiti has suffered setbacks due to the destructive hurricane, Hazel, in 1954, and to a continuing decline in the production of cotton because of the damage caused by the boll weevil, and in bananas as a result of Panama disease and Sigatoka. However, the completion of the dam across the Artibonite river at Peligre and the accompanying potential increase in irrigated land of the Artibonite valley offer promise for future expansion.

An outline of Haitian agriculture and food problems is not complete without the following basic information: Haiti is mountainous. The total area is 10,700 square miles or 2,775,000 hectares, of which approximately one-fifth is arable plain and one-seventh arable mountainous area. The rest by virtue of topography, rainfall, soil composition, etc. is not available for farming. In the plains area 200,000 hectares of the potential 500,000 are now used. An accurate estimate of the mountain area farmed is not available.

* The sections on Food and Agriculture, Food Technology and Vital Statistics were prepared by H. S. Olcott and G. Nicolas.

TABLE I
Location of the 3,113 Persons Examined

Location	No. Persons Examined	Institution	Characterization
I	23	Public Health Dispensary, La Saline, Port-au-Prince	Slum area
	53	Primary School, La Saline, Port-au-Prince	Slum area
	75	Public Health Dispensary, Carrefour	Poor suburb
II	73	Public Health Dispensary, Petionville	Suburbs of good economic status
	77	Public Health Dispensary, Kenscoff	
	147	Public Health Dispensary, La Boule*	
III	106	Public Health Dispensary, Mirebalais	Rural towns, valley and farming
	123	Public Health Dispensary, Croix des Bouquets*	
	132	Public Health Dispensary, Pont de l'Estere	
IV	132	Public Health Dispensary, Furcy	Rural, southern mountains
V	103	Public Health Dispensary, Gros Morne	Rural towns, northern mountains
	126	Public Health Dispensary, St. Raphael	
VI	143	Public Health Dispensary, Gonaives*	Urban, sea level
	166	Public Health Dispensary, Cap Haitien	
VII	111	Public Health Dispensary, Limbe*	Rural towns, north coastal plain
	159	Public Health Dispensary, Limonade*	
	84	Public Health Dispensary, Trou du Nord	
VIII	93	Public hospital, Cap Haitien	Urban, ambulatory patients
	96	Public hospital, Port-au-Prince	
IX	325	Albert Schweitzer Hospital, Deschapelles	Rural
X	25	Orphanage, mixed, Port-au-Prince	Public
	74	Orphanage, girls, Port-au-Prince	Parochial
XI	177	Guilloux boys school, Port-au-Prince	Parochial
	134	Guilloux boys school, Petionville	Parochial
	71	Guilloux boys school, Carrefour	Public
XII	204	Venezuela girls school, Port-au-Prince	Parochial
	81	Venezuela girls school, Kenscoff	Parochial

* In these institutions groups of school children were included with the patients attending the dispensaries for therapy.

Although these figures suggest that ample area exists for the expansion of farm land, there are great practical difficulties. The richest, most accessible areas are already densely populated. Lack of irrigation, lack of roads, irregular distribution of rainfall, and lack of proper soil types for known crops all contribute to the present disuse of some of the areas that could be cultivated.

Population pressure is high. The density is

350 to 400 per square mile of total area, or 1,100 to 1,200 per square mile of tillable area. This amounts to one-half acre (one-fifth hectare) for each individual, an extremely low value in comparison with those of most countries.

From 85 to 90 per cent of the population live on individual farms or in clusters of homes (mostly thatched-roofed huts) with less than fifty to one hundred individuals. The nature of this distribution may be illustrated by the following 1950 census estimates:

Area	Population
Cap-Haitien	30,000
Cap-Haitien surrounding country	150,000
Gonaives	18,000
Gonaives surrounding country	200,000
Jeremie	14,000
Jeremie surrounding country	220,000
Hinche	5,500
Hinche surrounding country	125,000

With the exception of a few large towns, the illiteracy rate is about 90 per cent. School facilities are available for approximately 20 per cent of the children between the ages of five and fourteen, but pupil attendance is irregular because of the distances involved, lack of transport, illness and the pressure of chores. Transportation between the various areas of Haiti is rendered difficult by the lack of good roads. During the rainy seasons some roads are rendered impassable by flooding streams. Most produce is carried to local markets in baskets on the heads of peasant women or in paniers on donkeys.

The majority of Haitians are illiterate farm families dependent for food on what they grow on their limited patches of land or on what they can purchase at local markets for the small amount of money they make by selling produce. It was estimated in 1949 (U.N. Mission) that the annual per capita income may be as low as $25, but a peasant family handles considerably less money than this. The legal minimum daily wage is Gdes. 3.50 (70¢; the gourde is stable at 20¢), but only a small portion of the population is employed.

Land holding problems are of the greatest seriousness. Whereas a few city and country residents own substantial amounts of land, the average peasant holds less than one-half of a carreaux (1 carreaux = 3.16 acres = 1.29 hectares). The Artibonite valley with 33,000 hectares of cultivatable land has a population of approximately 33,000 farm families, some of which have substantial holdings (up to 400 hectares). The remainder obviously have much less. Thus the peasant in many parts of the country is forced to grow multiple crops for family use with consequent low yields of each. Plantain, corn, congo peas, sweet potatoes, a mango tree and coffee trees may all be found on the same acreage. Under these conditions it is extremely difficult to estimate the acreage devoted to a single crop or to determine the total yield. An attempt to obtain this information was made during the 1950 census and although the data may be greatly in error, they are the best that can be obtained. A résumé appears in Tables II and III.

The foods available to the Haitian peasant are listed in Table IV. Within each category the foods have been placed in the approximate order of their importance in the Haitian diet, based in part on food production data, on observations in the market place, and on discussions with Haitians acquainted with the food habits of the rural population.

Corn and millet are the cereal mainstays. The diet is fortified with respect to calories by the starchy roots (sweet potato, yautia, yam and cassava), and by sugar, rice and plantain. Vegetable protein is furnished mainly by beans and nuts. The amount of high protein foods ingested is small and difficult to estimate.

The census of 1950 included an enumeration of livestock. Specialists in animal husbandry at the Department of Agriculture provided estimates of the changes which might have occurred since. Table V represents a rough approximation of present farm animal popu-

TABLE II

Principal Food Crops of Haiti (Area Under Cultivation)*

Crop	Area in Hectares	% of Area in Each Department				
		North	Northwest	Artibonite	West	South
Corn	310,000	11	3	34	31	21
Millet†	240,000	2	3	34	41	18
Coffee	145,000	15	7	4	28	46
Plantain	130,000	13	5	16	41	25
Sweet potato	105,000	13	11	16	29	31
Beans	97,000	21	7	27	28	17
Sugar cane	77,000	12	5	26	32	25
Rice‡	63,000	20	3	47	12	18
Banana§	48,000	34	25	36	..	5
Peanut	13,000	22	11	20	13	35
Cacao	9,000	15	7	4	28	46

* 1950 census. Subject to the errors discussed in the text. In addition, these areas probably represent the situation during the month of August. Since, in most parts of Haiti, two and sometimes three different crops are grown on the same area within one year's time, the figures shown may have little significance for different times of the year. The data for more or less permanent crops, such as coffee, cacao, plantain and cane, are probably of greater significance than the rest. Data for the Department of the South have not yet been published. We are indebted to Mr. O. Boigris, Institut Haitien de Statistique, for permitting us to see proof sheets.

† Millet and sorghum are not differentiated. Locally both are called "petit mil."

‡ In 1958, a good crop year, the yield of rice may reach 110,000,000 pounds.

§ The decline in banana production since 1950 makes these data obsolete. Exports of bananas amounted to 7,300,000 "stems" in 1946–1947. By 1950–1951 they had fallen to 1,340,000 stems. Figures for 1953–1954, 1954–1955, 1955–1956 are as follows: 393,000; 49,000; 164,000, respectively.

lation without, however, furnishing any information with respect to turnover rate.

No information is available concerning the production of milk or eggs. Goat milk is sometimes consumed in Haiti, chiefly by tuberculous patients.

In contrast to the lack of over-all data on the consumption of meat, milk or eggs, the amount of fish consumed in Haiti can be calculated with some degree of accuracy. From 13,000,000 to 19,000,000 pounds of smoked herring, dried cod fish and assorted salted fish are imported annually (Table VI). In addition, about 4,000,000 pounds of marine food products (fish, crab, etc.) are landed by Haitian fisherman each year. A program designed to introduce pond culture of fish in Haiti has not yet been successful. However, the introduction of the rapidly growing tilapia into Haitian rivers has succeeded and a considerable but unknown amount of additional fish is being caught by the Haitians. The amount of such fish used may be as large as 1,000,000 pounds annually, but it is probably much less. Thus the total annual consumption is probably the equivalent of between 20 and 25 million pounds of fresh fish, or 5 to 6 pounds per capita.

The marine fisheries of Haiti have never been adequately developed. An FAO survey has indicated that large quantities of bonito are available in Haitian waters (Report to the Government of Haiti and Maritime Fish in Haiti, FAO Report No. 721, Rome, August, 1958).

Comment on Individual Crops

Haitian coffee has a ready sale in the world market. It is extremely important to the economy as the largest single source of income. Yield and quality have suffered because of the peasants' lack of knowledge concerning care of the trees and the crop. Efforts are being made to increase the dissemination and use of such information. Since the Haitian coffee tree will grow and produce only in shade, any

TABLE III

Principal Food Crops of Haiti (Yields and Distribution)*

Crop	Pounds (in millions)	% of Area in Each Department				
		North	Northwest	Artibonite	West	South
Corn	471	5	5	32	35	23
Millet	383	1	1	44	28	26
Cassava	229	21	7	10	14	48
Sugar cane†	190	..	..	..	..	..
Sweet potato	175	11	9	25	27	28
Plantain	101	12	8	20	38	22
Rice	92	6	1	72	9	11
Beans	75	11	2	30	39	18
Coffee	63	4	7	3	41	45
Yam	41	9	17	4	16	54
Yautia	29	9	6	6	10	69
Peanut	5	13	3	23	21	40
Cacao	4	12	3	3	2	80
Distribution of population	..	17	5	19	35	24

* Cf. footnotes to Table II.

† In terms of sugar. For rough approximation, 1 ton of cane yields 200 pounds of sugar. The census data for yields in the various departments are not internally consistent and have therefore been omitted.

increase in production requires that shade trees be planted first.

Corn is grown in all parts of Haiti and on almost every square foot of plantable land including the sides of drainage ditches and steep and stony hillsides. Yields per acre are therefore extremely poor. Even on good land agricultural practices are wasteful, and information on better agricultural practices already available is not used. Thus fields may be and are extensively damaged by insect infestation, which the application of a few cents worth of insecticide could have prevented. Often, the peasant has neither the few cents nor the knowledge that this could be done. Yields could also be tremendously increased by irrigation wherever this is possible, by the use of new varieties of seed, and by the adoption of the already developed practices used in more advanced agricultural regions.

Millet and sorghum are more resistant to drought than corn and can be grown in areas where corn will not produce a comparable yield. Millet Chandelle, grown almost exclusively in the Gonaives area, is reputed to have exceptional nutritional properties. Analyses of samples are being carried out in connection with this survey.

Rice is a favorite cereal in the Haitian diet, but it is more expensive than corn or millet. In the irrigated areas, seed imported from the southern United States is found to give the best yields. A "mountain" rice is grown in areas of higher elevation which have adequate rainfall. The development of irrigation projects in the Artibonite valley is continually bringing more land into effective rice production. However, this area (approximately 10,000 hectares), still remains smaller than that which was devoted to rice culture before flood control and drainage projects were started. Thus several thousands of hectares were rendered infertile. After an interval of several years the development of canal facilities for irrigation will return the land to agricultural use.

An invasion by rats during the 1957 crop year was responsible for the loss of tremendous quantities of rice—perhaps as much as 10,000,000 pounds in the Artibonite valley alone. Pesticides, such as warfarin and zinc phosphite, were successfully used to kill over

TABLE IV

Food Crops of Haiti*

English Name	Haitian Name	Latin Name	Approximate Annual per Capita Consumption† (lb.)
Cereals:			
Corn	Mais	*Zea mays*	120
Millet	Petit mil (chandelle)	*Pennisetum typhoideum*	95
Sorghum	Petit mil (gros)	*Sorghum vulgare*	
Rice	Riz	*Oryza sativa*	23
Wheat flour	Farine de blé	*Triticum aestivum*	20
Starches:			
Plantain	Banane	*Musa paradisiaca*	240
Cassava‡	Manioc	*Manihot utilissima*	56
Sweet potato	Patate	*Ipomoea batatas*	44
Yam§	Igname	*Dioscorea alata*	10
Breadfruit	Arbre véritable	*Artocarpus incisa*	..
Breadfruit‖	Arbre pain	*Artocarpus incisa*	..
Yautia	Malanga	*Xanthosoma terviride*	7
Potato	Pomme de terre	*Solanum tuberosum*	..
Dry legumes, nuts:			
Dry beans¶	Pois rouge	*Phaseolus vulgaris*	10
Pigeon peas	Pois congo	*Cajanus indicus*	..
Peanuts	Pistache	*Arachis hypogaea*	..
Blackeye peas	Pois inconnu	*Vigna sinensis*	..
Lima beans	Pois de souche	*Phaseolus lunatus*	..
Coconuts	Coco	*Cocos nucifera*	..
Cashew	Noix d'acajou	*Anacardium occidentale*	..
Fresh vegetables:**			
Pumpkin	Giraumon	*Cucurbita pepe*	..
Chayote fruit	Mirliton	*Sechium edule*	..
Squash	Courge	*Cucurbita sp.*	..
Cabbage	Chou	*Brassica oleracea*	..
Green leaves††	...	...	..
Tomato	Tomate	*Lycopercicum esculentum*	..
Egg plant	Aubergine	*Solanum melongena*	..
Green beans	Haricots verts	*Phaseolus vulgaris*	..
Okra	Calalou	*Hibiscus esculentus*	..
Shallot	Échalote	*Allium ascalonicum*	..
Peas	Petis pois	*Pisum sativum*	..
Chives	Cive	*Allium schoenoprasum*	..
Fruits:§§			
Mango	Mango	*Mangifera indica*	..
Banana	Figue banane	*Musa sapientum*	..
Orange‖‖	Orange	*Citrus sinensis*	..
Avocado	Avocat	*Persea americana*	..
Grapefruit	Chadeque	*Citrus grandis*	..
Melon¶¶	Melon	*Cucumis melo*	..
Mamey	Abricot	*Mammea americana*	..
Pineapple	Ananas	*Ananas sativus*	..
Soursop	Corossol	*Annona muricata*	..
Granadilla	Grenadine	*Passiflora quandrangularis*	..
Guava	Goyave	*Psidium guajava*	..
Caimito	Caimite	*Chrysophyllum caimite*	..

See footnote on opposite page.

TABLE V

Number and Distribution of Livestock in Haiti (Based on 1950 Census*)

Livestock	No.	% of Total by Departments				
		North	Northwest	Artibonite	West	South
Cattle	640,000	18	4	19	29	30
Pigs	1,250,000	15	4	24	31	26
Poultry†	4,400,000	17	3	25	27	28
Goats	850,000	13	7	23	28	29
Sheep	60,000	15	17	20	10	38

* Subject to the errors mentioned in the text (see footnote to Table II). The estimates for number of cattle and pigs are 10 per cent greater and for poultry 15 per cent greater than the 1950 data.

† Chickens, includes 1 per cent or less of turkeys. Ducks and geese are rare.

500,000 rats. The extermination program is continuing. Birds are responsible for a noteworthy loss of rice and millet, possibly to the extent of 10 to 20 per cent in some areas. No effective means for their control are known.

The sweet potato (patate), yautia (malanga) and yam (igname) are high-yielding crops which furnish a large proportion of the calories in the Haitian diet. They are most often grown together with corn or plantain. Yields are relatively large. Possibly as much as 20 per cent of the sweet potato crop is lost by rot or nematode or insect infestation.

Many fresh vegetables can be grown in Haiti if and when proper demand and mar-

TABLE VI

Imports of Fish into Haiti*

Year	Pounds
1951–1952	18,200,000
1952–1953	14,400,000
1953–1954	18,900,000
1954–1955	13,300,000
1955–1956	15,200,000

* Valued at between $1,200,000 and $1,750,000. In 1955–1956, the relative amounts of various products were as follows: dried cod, 14 per cent; smoked herring, 40 per cent; salted herring, 42 per cent; others, 4 per cent. More than 95 per cent is obtained from Canada.

* In each category the crops are listed in an approximate order of importance with regard to per capita consumption.

† Based on census estimates of crop production and on imports.

‡ Two kinds of manioc are grown, manioc amer (bitter) and manioc doux (sweet). The latter (*Manihot cassava*) is a smaller root and the skin is lighter. It accounts for about 10 per cent of the manioc production.

§ The Haitian yam is a large, irregularly shaped root. A separate smaller variety (*Dioscorea occidentalis*) is "Igname siguine."

‖ "Arbre pain" contains 25 to 50 nuts which are usually the only part eaten. It is less important than "arbre veritable."

¶ Several additional varieties of *Phaseolus vulgaris* are available; e.g., "pois blanc," "pois noir," "pois navet."

** The following vegetables are also grown, mostly for the city market: carrot (carotte, *Daucus carota*), beet (betlerave, *Beta vulgaris*), cucumber (cocombre, *Cucurbita sativus*), onion (oignon, *Allium cepa*), turnip (navet, *Brassica rapa*).

†† A number of different leaves are used. The more common bear the following local names: cresson (watercress, *Rorippa nasturium aquaticum*), Lanman, epinard, caya, pourpier, panzou. The leaves of the bean, chayote, pumpkin and caraibe are also offered in local markets.

§§ The following fruits are also available in season but in smaller quantities: lime (citron, *Citrus aurantifolia*), papaya (papaye, *Carica papaya*), peach (pëche, *Prunus persica*), sapodilla (sapotille, *Achras sapota*), cashew (pommes cajou, *Anacardium occidentale*), pomegranate (grenade, *Punica granatum*), sweetsop, custardapple (cashiman, *Annona squamosa, A. recticulata*), quenepe. With the exception of sweet oranges, grapefruit, bananas and pineapple, the fruits of Haiti grow wild.

‖‖ The sour orange (orange sure, *Citrus aurantium*) is also widely available. The juice is used for washing meat, yam, etc.

¶¶ Includes the watermelon (melon d'eau, *Citrillus vulgaris*).

keting systems can be developed. Those available at present in the smaller markets are limited for the most part to eggplant, okra, green beans and the native tomato; nevertheless, tomatoes, onions, beets, potatoes and carrots have recently become available in the Port-au-Prince marketing area. These are considered cash and not subsistence crops. Similarly, certain areas of Haiti could be used for the production of orchard fruits, such as the peach, plum and grape, if markets were developed. The U.N. Mission recommended the introduction of the mangosteen, Japanese persimmon and pomelo. The mango is the most abundant fruit of Haiti. During the four- to five-month season, the Haitians probably consume at least 2,000,000,000 mangoes. A considerable but unknown number are eaten by pigs or rot on the ground.

Preservation, Transportation and Marketing

The perishable crops of Haiti are marketed as soon as they are harvested. Cereal grains are first dried, if necessary, by exposing them to the sun on cement slabs or on pounded earth. Excess grain is stored in cleaned 55 gallon oil drums, in shallow cement wells or in thatched huts built on tall stilts supplied with devices to prevent access to rats. Dried corn is often stored on the husk-protected cob, in bundles of several hundred cobs, suspended by wires or ropes from the branches of trees.

The crops are taken to market in baskets carried by the women on their heads, or on the backs of donkeys. Transportation over longer distances is effected by autobuses which carry passengers and produce together or, less often, by truck. The railroad lines in Haiti are operated by sugar and sisal companies, and are used principally to carry sugar cane, sugar produce and sisal in the Port-au-Prince and Cap-Haitien areas. Total trackage is less than 200 miles.

All trading of food crops is done in local markets held usually one or two days each week. Port-au-Prince and the larger towns have provided covered pavilions for the purpose, but on busy days market activity expands into the surrounding streets. In the villages trading is out-of-doors. Buying and selling is carried on from small stocks placed directly on the floor or ground, or in woven baskets or dishes. Sometimes coffee and sugar are sold by weight, but usually foods are sold by the piece or from cans or cups of various non-standardized sizes. For export crops, such as coffee, cacao and cotton, brokers buy small odd lots from the individual, then forward their combined purchases to the port cities. Similarly for the distribution of imported products, brokers sell relatively larger amounts to market women who, for example, cut up the fish into pieces which can be sold for a few cents or who melt the 5 pound can of lard and dispense it in amounts as small as a fraction of an ounce.

However inefficient the market day system may be, it provides a social outlet for the peasant women who are otherwise almost completely isolated from human contacts outside their own families.

FOOD TECHNOLOGY

Commercial food processing in Haiti is limited to the following: manufacture of sugar products from cane, expression of cottonseed oil and refining and blending of this and of imported edible oils, the manufacture of rum and other alcoholic drinks (clairin, tafia), and coffee drying and decortication. A large modern flour mill was scheduled to begin operation in 1958. Small scale operations include the grinding of corn, essential manufacture of oil and milling. Bakeries and soft drink bottling plants operate in the large cities. There is no canning, freezing, dehydrating or pickling.

The Haitian-American Sugar Company (HASCO), Port-au-Prince, has a capacity for producing up to 75,000 tons of sugar annually. Production varies depending upon the availability of cane. About 40,000 tons are consumed in Haiti. Surpluses are exported. Thus in 1955-1956, 36,000 tons of crude sugar were exported, 32 per cent to Japan, 25 per cent to the United Kingdom, and the rest to the United States, Belgium and Korea. Molasses is disposed of by export. Products of this company for Haitian use are distributed as refined sugar (about 22 per cent), and the rest as "sucre populaire," about 97 per cent sucrose

The two sell for about 8 and 6 cents per pound, respectively. Small sugar processors operate at Cap-Haitien and Cayes. The production of these plants is estimated at 1,500 to 3,000 tons annually, although the capacity of the latter is 20,000 to 30,000 tons. Lack of available cane and the low sugar content of the local crop, as well as mechanical difficulties, account for the small output of the Cayes mill.

On the basis of estimates that the mills absorb only about one-half of the cane grown in Haiti, that most of the rest is crushed to juice and that half of this is used to make sugar products ("sirop" and "rapadou"), it may be calculated that the annual per capita consumption of sugar from cane is 30 to 40 pounds. This is considerably less than the 100 and more pounds of sugar consumed in more highly developed countries. The cane juice not evaporated for syrup products is used in the manufacture of the alcoholic drinks: rum, clairin and tafia.

The two companies which divide about equally the manufacture of cottonseed oil are Huilerie Nationale, S.A. and S.A. Usine a Manteque de Port-au-Prince, both in Port-au-Prince. These companies are equipped with conventional gins, cookers and presses, and operate at or near capacity when cotton production is high. However, cotton production has been declining gradually during the past twenty years, in part due to the encroachment of the boll weevil, and in part due to lack of the grower's incentive to take care of or reap his crop. The local cotton plant is a perennial (Gossypium barbadense). Production of cotton seed has fallen from about 14,000 tons to about 3,500 tons annually. The Haitian requirements for edible oils are met by the importation of lard, soybean oil and smaller amounts of other oils. In 1955–1956, 3,600 tons of lard and 1,100 tons of soybean oil were received. Together with an estimated production of 500 to 1,000 tons of local cottonseed oils, the total amount of available processed fats and oil amounts to 5,000 to 6,000 tons. Thus the average per capita consumption of processed oils and fats is about 2.5 to 3 pounds annually.

The Haitian processors refine both their own cottonseed oil and the imported soybean oil. The imported hardened fat is used for the manufacture of a blended vegetable fat compound. There are no facilities for hydrogenation of oils or solvent extraction of cottonseed cake. The latter is largely exported; one-third is said to be used in Haiti as cattle feed or manure.

Coffee is the most important single source of revenue (65 to 80 per cent of the value of total exports). About one-fifth of the crop is used locally and the rest, amounting in 1955–1956 to about 34,000 tons (valued at $33,400,000), is exported. Drying and decortication are carried out by all technics from the most primitive to that using the best modern equipment. There are no large plants but a number of coffee dryers and decorticators are scattered throughout the country.

The wheat flour mill (Caribbean Mills Co., Port-au-Prince), which began operations in 1958, can provide for the entire requirements of Haiti. Wheat was grown only in three small projects in 1955 on the island, although bread and other wheat products are popular foods. This need has hitherto been met by importing wheat flour. In 1956–1957 this amounted to 37,000 tons (approximately 20 pounds per capita annual consumption). With the mill in operation, wheat as such will be imported (from Canada and the United States). The mill is designed to produce 350,000 pounds of high protein flour daily. If it operates 300 days a year at this capacity, it will produce 52,000 tons of flour or an amount approximately one-third more than Haiti can absorb. It is planned to export this surplus to surrounding Caribbean islands. The daily yield of 35 tons each of shorts and bran will be exported unless markets can be developed locally. No consideration has yet been given to an enrichment program for the flour.

A small clean rice milling plant is run by the ODVA (Organisme de Developpement de la Vallee de l'Artibonite) in the Artibonite valley as a service to the rice growers of the area but, in general, rice is milled at home in large wooden mortars, or is taken to one-room mills in the villages. Most of such equipment is of Hamburg origin. Rice is often parboiled at

home by heating a large drum containing a small amount of water and filled with rice (50 pounds). After the rice is thoroughly steamed, it is spread on cement slabs to dry. The hardened kernels are valued because the yield during milling is greater. Increases of as much as twenty per cent are realized. There is no recognition by the Haitians of the known nutritional benefits of parboiling.

Corn grinding equipment is similarly small and widely scattered. The peasants themselves sift the ground corn so that both flour and coarse meal of many grades are offered in the markets.

One large and ten or twelve small essential oil plants are scattered throughout the country. The oils manufactured are amyris, vetiver, lemon-grass, lime and others. Total exports in 1955–1956 amounted to 260,000 pounds.

A large modern distillery and a number of primitive stills produce the alcoholic requirements. Yeast fermentation of concentrated cane juice or diluted cane molasses provides the raw material for these stills. The amounts of rum, clairin and tafia consumed are not known. If the equivalent of 20,000 tons of sugar is fermented, it may be estimated that 10,000 tons of alcohol are produced or the annual per capita consumption is roughly 5 pounds of alcohol (1 to 2 gallons of rum). This figure may be greatly in error.

Some years ago an American company investigated the possibility of establishing a pineapple canning industry in the Cap-Haitien area. It was found feasible to produce suitable pineapple on plantations and a plant was erected. However, before production began the economic situation changed and the project was abandoned.

Salt is manufactured in Haiti in the Gonaives and Port-au-Prince areas by solar evaporation of sea water in dirt basins. When sufficient crystals have formed on the sides and bottoms and on branches, which are used to increase the surface for crystallization, the salt is harvested by hand. The branches are stripped into wicker baskets, the crude salt is washed with the mother liquor and dried in piles in the sun. This grayish large crystal salt comprises most of the salt marketed in Haiti. According to M. Routh, FAO Fisheries Specialist, the impurities render it unsuitable for salting fish. Any increase in fish-salting activity would require either the introduction of technics for purifying salt or the importation of salt of high purity.

SECTION OF VITAL STATISTICS

There exists no reliable statistical information on the number of people, births, deaths, causes of deaths, etc. in Haiti. The only census ever made was obtained during a twelve-hour period on a Sunday in August 1950 (total reported population 3,111,689). This figure is admittedly only a rough approximation. Complete records on births and deaths have never been obtained. The following figures are therefore only studied guesses: Total population, 3,800,000 ± 400,000; births, 180,000 ± 20,000 (45 per 1,000); deaths, 85,000 ± 15,000 (25 per 1,000). Infant mortality (deaths of children below the age of one) is high. The practice of burying dead infants without registration or funeral is admittedly widespread. An estimated infant mortality of 200 to 250 per 1,000 live births therefore may be low. Of those who survive to one year of age, 200 to 250 more die within the next four years. These approximations lead to the conclusion that only one child of two born alive survives to the age of five years.

It has been suggested (C. Bengoa, personal communication) that the ratio of deaths of children below five years of age to total deaths may be useful as an index of nutritional and health standards in a population. Such ratios are fairly easy to approximate since they do not depend on having a complete record of deaths. In Table VII are listed total registered deaths and percentage of deaths of children below five years of age for several communities in Haiti for two separate years. The over-all ratio of 47 per cent may be considered to be an absolute minimum in view of the practice, already mentioned, of not recording infant deaths. This figure may be compared with those reported for Egypt, 59 per cent (1952), Costa Rica, 55 per cent (1954), and the Dominican Republic, 53 per cent (1953),

TABLE VII

Comparison of Deaths of Children Below the Age of Five to Total Recorded Deaths in Selected Communities of Haiti (1955 and 1956)*

Community	Year	No. Recorded Deaths	No. Deaths of Children Below Five	Per Cent
Port-au-Prince	1955	2,110	982	47
	1956	2,872	1,570	54
Cap-Haitien	1955	248	94	38
	1956	202	61	30
Saint Raphael	1955	353	171	48
	1956	364	168	46
Limbé	1955	266	91	34
	1956	308	106	34
Limonade	1955	235	68	29
	1956	275	86	31
Total		7,233	3,397	47

* The data for Port-au-Prince were obtained from the Bulletin Trimestriel de Statistique, No. 25, June 1957. Those for the other cities were obtained from the original death registers in the Office de l'Etat Civil, Cap-Haitien.

TABLE VIII

Causes of Death (1950 and 1951)

Causes	% of Total Deaths	
	1950 (1,905)	1951 (1,825)
Non-specific or poorly defined	10.6	...
Tuberculosis	6.7	9.3
Nephritis	4.9	2.7
Diarrhea and enteritis (in children under two years of age)	4.6	...
Infection during childbirth	4.6	...
Malaria	4.1	5.8
Premature birth (not including stillborn)	3.7	...
Tetanus	2.9	6.2
Meningitis	2.5	2.4
Sudden death	2.4	...
Debility	...	4.8
Functional stomach difficulty	...	4.4
Gastroenteritis	...	4.3
Helminthiasis	...	2.3
Cerebral hemorrhage	...	2.2
All other causes	53.0	55.6
In children below five years of age	...	43.0

NOTE: Figures in parentheses represent total number of deaths.

countries having similar difficult problems of economics, health, nutrition and statistics; and contrasted with statistics from Japan, 18 per cent (1953), Uruguay, 12 per cent (1954), United States, 8 per cent (1953), and England, 4 per cent (1953), for countries which have overcome some of these difficulties.

The data presently available on causes of death cover only those which occurred in hospitals. In the most recent report (Rapport Annuel Bio-Statistique du Service de la Sante Publique, 1951; Imprimerie de l'Etat, Port-au-Prince, 1958) the causes of deaths are tabulated for 1,825 persons during 1951 and for 1,905 persons during 1950. Since these represent only 2 to 3 per cent of the total deaths, and are a partially selected population (those who get to hospitals), the causes of deaths can have only qualitative significance. The more important causes for each year are listed in Table VIII.

Conversations with A. Garnier and M. Feier, Department Biostatistique, were helpful in developing this information. A vigorous program to improve the quality of biostatistical information is now in progress.

DIETARY STUDY*

Prior to this survey, little effort had been made by any group to determine the nature of the Haitian diet. During the conduct of our study, "A Dietary Study in Haiti," by Faye W. Grant and Dale Groom was published (*J. Am. Dietet. A.*, 34: 708-716, 1958). They made a dietary study of seventy families in the La Saline area of Port-au-Prince. Their findings are essentially in agreement with our much more extensive observations. The only earlier information in the nutrition literature on the types of food, methods of preparation, nutrient intake, or dietary habits of the Haitian people is provided by a summary, "Une Enquete Alimentaire en Haiti" by Carlos

* The team making dietary studies included G. P. Barron, F. Berger, and C. E. French, assisted by M. Frederique and L. Gemeau.

Boulos (*Bulletin Le l'Association Medicale.* Haitienne, 6: 185-188, 1954). This was based on data obtained from sixty-five families in an area similar to that studied by Grant and Groom. Food Composition tables available from the United Nations and other agencies are inadequate for use in evaluating the nutrient intake of these people, as the diet includes a large variety of wild leaves and buds of unknown composition.

Methods

Most of the information in this report was obtained by diet history interviews. It was necessary to depart from methods that would give precise quantitative data on nutrient intake, since such methods require more time and personnel than were available. Diet histories are valuable only in obtaining qualitative information. Efforts were made to obtain information that could be used in a semiquantitative assessment of nutrient intake, but the data obtained are subject to the inherent inaccuracies of the diet history method.

Interviews were made and diet histories were obtained in all locations in Haiti where the clinical team worked. (Table I.) Most of the information was obtained from persons who visited the Public Health Dispensaries where the clinical team conducted examinations.

Some diet histories were obtained by interviews at home demonstration schools operated by the government in rural areas. At these schools, young girls (fifteen to twenty years of age) were interviewed. The teachers in these schools were of great help in providing information on the foods available in the area and the types of meals consumed by the people.

Visits were made to many homes in the rural areas where the housewife was interviewed. These visits had to be arranged by a government home demonstration agent, as the peasant housewife is reluctant to give information to foreigners who wish to observe her preparation of food. The cooperation and assistance of the local government agent overcame this problem.

In addition, local markets were visited to observe the types of food available and their current prices. This, too, necessitated the assistance of Haitian personnel in obtaining "true" market prices instead of inflated tourist prices.

It was fully realized that diet histories and interviews are of most value in determining food habits, patterns of intake and information of a qualitative, rather than quantitative, nature. Nevertheless, efforts were made to obtain as much quantitative data as possible while conducting interviews and recording diet histories. This was no easy task in that the average peasant has little knowledge of his food intake in terms of weight, and only slightly more knowledge of his expenditures for various food items.

Table IX was prepared from meager information obtained on food intake, which at best can be viewed only as approximate. The bulk of the information was obtained by ascertaining how much a family or individual spent in a week for a particular food item, then the intake (weight) was calculated on the basis of the current market price. The average intake per person was calculated by dividing the quantity of food by the total number of persons in the family. No adjustment seemed feasible to account for smaller intakes of children or larger intakes of adults, although such would have added much to the knowledge of actual food intake of these groups. The figures in Table IX represent the average intake of 460 persons (223 adults and 237 children under twelve years of age).

The method of arriving at the values in the table leaves much to be desired, but it was viewed as a feat of no small measure to obtain any definite information from the peasant class of people. Determining the number of persons comprising a family group might seem a simple chore to the average American, but difficulty was experienced in many instances. The peasant farmer often has two or three widely separated plots of land that he cultivates, and usually he has a "garden wife" and children at each plot to prevent the theft of his crops. It is understandable that often the number of wives and children, as well as his food purchases for the individual com-

TABLE IX

Calculated Intake of Some Foods* of 223 Adults and 237 Children (gm./person/day)

Food	Areas of Interviews										
	Average of all areas	Port-au-Prince	Carrefour	Mirebalais	Leogane	Furcy	Croix des Bouquets	Gonaives	Gros Morne	Pont de l'Estere	Cap Haitien
Beans	30	27	44	23	27	17	31	..	41	..	29
Rice	19	20	31	14	10	6	36	..	..	..	18
Corn	63	81	87	75	55	54	41	..	..	..	50
Millet	27	..	10	25	27	24	30	..	..	..	44
Bread	25	34	37	31	30	..	31	6	20	16	31
Bread of cassava	6	..	..	..	12	..	..	20	..	5	..
Fish	8	4	..	7	..	..	4	8	9	16	31
Meat	22	38	..	19	6	7	29	21	23	27	27
Milk†	85	..	..	32	..	109	76	200	86	15	77
Oil or lard	9	9	..	12	..	2	7	9	7	11	14
Plantain	100	..	66	130	88	..	..	..	..	117	..
Mangoes	420	136	..	630	525	..	263	630	420	472	525
Avocado‡	91	..	..	..	..	..	..	..	83	80	111
Sugar	40	50	..	..	..	42	27	..	..	..	..

* Values were calculated from data obtained by interview. Blanks in table do not mean absence of that food from the diet, simply that insufficient information was obtained through the interview.

† In areas where milk was reported only 34 per cent of those interviewed reported it.

‡ Corrected to edible portion; very seasonal.

ponents of his family, are matters beyond accurate memory of an illiterate head of a family. In many cases the head of the family could not give the number of children borne by his wives. One proud father reported fifty-two children, but it was not determined if this number was correct. Few peasants can count that high. The illiteracy made it difficult to obtain the ages of children in the family. Many mothers knew the number of children, but were unable to state their ages.

The sharing of food by neighboring families further complicated the calculation of food intake by the approach employed in this study. In some of the more poverty-stricken rural areas several families shared huts and available food. As many as twenty individuals ate from the same food pot, with all families contributing what they could to the day's food. It was an impossibility to get any useful information from persons living in such an environment and under such adverse conditions.

Table IX does not include all the foods that are normally found in the Haitian diet. Only those foods are listed on which some "semiquantitative" information was obtained as to their use. The absence of values in the table does not indicate that a particular food was not eaten in a given area, but simply that insufficient information was available as to the use of the food.

Several inconsistencies are evident in the values given in the table. For instance, it would appear that the average intake of meat was 22 gm. per day as calculated for this table. Actually, meat is usually reserved for the working males of the family and is not shared equally among the members. This fact was observed on visiting several peasant families, and confirmed by home economists or agents living in rural areas and having a good knowledge of the peasant food habits. Adult males, during interviews, denied their lion's share of the meat, but women repeatedly reported that most of the meat was given to the men of the family.

The use of the cereals, rice and millet, as listed in Table IX, does not agree with the

information of Table III pertaining to crop yields in Haiti. Rice is not consumed to the extent reported by the peasants, and perhaps twice as much millet is eaten. This is not startling in view of the pride of the peasant. Millet is referred to as the "poor man's rice" by higher classes of Haitians, and the peasant tended to overestimate his consumption of rice and underestimate his actual consumption of millet. A limited amount of rice is consumed by the peasant class because of its cost relative to corn and millet.

It would be fortunate if the average intake of milk was 85 gm. per person per day, as shown in Table IX. As a class, the peasants do not purchase milk, except in rare cases in which the mother feels her malnourished child will die if milk is not given. The use of milk was reported largely by families that possessed a cow, and milk was consumed when there was a surplus that could not be converted into cash. Only rarely was there a report of daily use of milk by a family, and then it was usually the children who consumed it. Reports of walking long distances to obtain milk for infants and young children were recorded. One mother reported walking 8 miles each week to purchase 1 L. of milk for a severely undernourished daughter. Four other children in the family sometimes shared the milk, making all shares insignificant.

Much discussion was given to the validity of the quantity of avocado reported as consumed. Members of the survey team who were natives of Haiti were in disagreement on the figure, 91 gm./man/day, some believing it too high and others being of the opinion that it was too conservative. All were in agreement that it would be difficult to estimate the intake of avocado for several reasons. Production varies with the regions, several sizes are available, and frequently the peasant has access to several of his own or a neighbor's trees from which he harvests at his desire. Under such circumstances, it is hard to estimate his intake. Of course many peasants do not live in regions where avocados are grown to any great extent, but still they are usually found in the local market during season and can be purchased quite reasonably.

Mangoes are consumed in great quantities, but as was the case with avocados, the quantity given in Table IX may be in error due to the inability of the average person to estimate his intake when the fruit is in season. There were reports of this fruit serving as the only food eaten during a day, but fortunately these were exceptions rather than the rule. However, it was obvious that when the fruit is in season mangoes contribute greatly to the average peasant's daily food intake.

Citrus fruits were not in season at the time of this survey and are omitted from Table IX due to indefinite information on their consumption.

An effort has been made to calculate the total daily nutrient intake based on the information presented in Table IX plus information obtained through other means, such as interviews with teachers and home economists in rural areas, observance of purchases at roadside stands and markets, and the direct observation of preparation of meals in the peasant homes. The summary of the data obtained is presented in Table X.

Group I of Table X lists the nutrients comprising the foods found in Table IX. In group II of the table other foods or groups of foods found in the average diet have been listed with the estimated intake of each. The total daily intake of nutrients is the sum of those in groups I and II. There is no claim to high degree of accuracy in the figures presented, but they represent the best information that was obtainable through the methods that were employed.

In a previous dietary study in Haiti, Grant and Groom (*J. Am. Dietet. A.*, 34: 708, 1958) reported a daily caloric intake for adults in the La Saline area of Port-au-Prince as ranging from 980 to 2,307 calories. In computing the daily intake of nutrients, children over six years of age were classified in the adult group. The average caloric intake of three family classes (all considered lower, but classified as to income into three categories) was 1,572 calories per adult per day. Lower intakes were calculated for the few rural families that were studied. The average caloric intake per person per day, as determined in the present study and reported in Table X, was 1,580

TABLE X
Estimated Nutrient Intake Per Capita Per Day

Nutrient	Consumed (gm.)	Energy (cal.)	Protein (gm.)	Fat (gm.)	Vitamin A (I.U.)	Vitamin B_1 (mg.)	Vitamin B_2 (mg.)	Niacin (mg.)	Ascorbic Acid (mg.)	Calcium (mg.)	Iron (mg.)
Group I											
Beans	30	102	6.6	0.51	9	0.16	0.05	0.69	0.09	41.1	2.61
Rice	19	68	1.3	0.21	0	0.04	0.01	0.72	0.0	2.7	0.19
Corn	63	224	6.0	2.71	284	0.28	0.07	1.26	0.0	4.4	1.45
Millet	27	92	2.6	0.81	0	0.08	0.03	0.27	0.0	8.1	1.08
Bread	25	60	2.3	0.65	0	0.08	0.03	0.75	0.0	24.0	0.55
Bread of cassava	6	20	0.1	0	0	0.0	0.0	0.10	0.0	0.7	0.10
Meat	22	31	3.5	1.76	4	0.01	0.04	0.70	0.0	2.0	0.42
Fish	8	6	1.1	0.09	0	0.0	0.03	0.12	0.0	1.7	0.05
Milk	85	55	3.0	3.00	119	0.03	0.15	0.09	0.85	101.2	0.09
Oil or lard	9	80	0.0	9.00	0	0.0	0.0	0.0	0.0	0.0	0.0
Plantain	100	75	0.8	0.30	200	0.04	0.05	0.70	11.00	9.0	0.50
Mangoes	420	168	1.7	0.40	7,980	0.05	0.25	2.52	201.60	46.0	1.68
Avocado	91	142	1.2	14.30	309	0.09	0.40	1.30	9.10	13.7	0.82
Sugar	40	148	0.0	0	0	0.0	0.0	0.0	0.0	0.0	0.0
Total	...	1,271	30.2	33.7	8,905	0.86	1.11	9.22	222.64	254.6	9.54
Group II											
Roots and tubers	170	165	1.9	0.5	950	0.14	0.06	0.85	32.00	47.6	0.06
Vegetables and leaves	125	27	2.5	0.3	3,546	0.08	0.15	0.76	56.30	124.0	1.73
Flour	20	73	2.	0.2	0	0.03	0.01	0.20	0	3.2	0.20
Sweets	10	44	0.8	1.6	3	0.01	0.01	0.50	0.50	3.8	0.20
Daily total	...	1,580	37.4	36.3	13,404	1.12	1.34	11.53	311.44	433.2	11.73

NOTE: Group I represents nutrients contained in foods listed in Table IX.
Group II represents nutrients contained in other foods found in average diet.

calories. No distinction was made for age groups in arriving at this figure but, naturally, the average intake for adults would be higher if some adjustment had been made for the smaller caloric intake of children.

Grant and Groom gave the average protein intake per day for adults in the three classes as 25, 42 and 68 gm. An average of the three classes would be about 44 gm. of protein per adult per day. Perhaps the figure arrived at in the present study, 37.4 gm., would approach or exceed 44 gm. for adults if adjustment could have been made for the intake of children. If it is true that most of the family meat is eaten by the working males, little or no animal protein is consumed by women and children. On the basis of the consumption of meat, fish, milk and eggs, one would conclude that animal protein is present in negligible amounts in the diet of the average peasant.

The average intake of fat, as reported in Table X, was 36.3 gm. per day, with almost half being contributed by the avocado. Therefore, it is reasonable to assume that the fat intake is drastically reduced when this fruit is not in season. Likewise, the intake of riboflavin would be reduced due to the importance of the avocado in providing this vitamin. The desire for fat by the peasant was evident, as reported elsewhere in this text, and certainly the diet could be improved if additional sources of fat were available. According to the figure,

36.3 gm., fat contributes only 21 per cent of the daily calories during the avocado season and much less when this fruit is not in season. Grant and Groom reported an average intake of 57 gm. per adult per day. The contribution of calories by fat in the Haitian diet is much less than that found in American diets in which approximately 44 per cent of the calories is contributed by fat.

The fondness for sugar and sweets was considered rather unusual in that most of the calories of the diet are contributed by carbohydrate or starchy foods. Rarely was a person interviewed who did not report the use of sugar or "rapadou" in his coffee. Four to six teaspoonfuls of sugar are usual quantities used, an amount that would be considered excessive by the most ardent sugar-loving American. Further, sugar is used in large amounts in leaf teas, "bouillie" (corn or wheat flour plus milk, coconut milk or water and sugar), and in "acassant" (finely ground corn cooked with a little water or milk and sweetened). In addition, most children and adults reported weekly purchases of cola (a bottled drink containing 12 to 15 per cent sugar) and candies of various sorts. A peanut brittle-like candy, "tablett," was a favorite that could be purchased in even the remotest areas from vendors who peddled their wares along roads and trails. Baked pastries were not eaten in great quantities by the average peasant, perhaps due to the cost, but it was noticed that the sale of these in the cities was good. No reasonable estimate could be made of the carbohydrate intake through the chewing of sugar cane by all age groups.

The value listed in Table X for the daily consumption of sugar (or "rapadou"), 40 gm., is higher than that reported by Grant and Groom for the two lower classes (15 and 25 gm.), but the information obtained in the present study would not indicate 40 gm. as being excessive. This figure does not include carbohydrates consumed in "sweets" such as sugar cane, cola, candies and pastries.

Reference has been made to the study conducted by Grant and Groom in the La Saline district of Port-au-Prince. Some information for the present report was obtained from the same district, but most was obtained in rural areas from the peasant class of people who are in the majority in Haiti. The activities and habits of the peasants are somewhat different from those of the people living in La Saline. Poverty is one thing the two groups have in common.

Food Costs

A survey conducted by government workers and reported in a Haitian publication (Bull. Trimestriel de Statistique No. 24, 1957) indicated that the average peasant family (4.9 persons) spent about 44 cents per day for food, or about 9 cents per person. These figures are subject to errors in the translation of the Haitian report, but from the information obtained in the present study and reported herein, it would be the opinion that 44 cents per family per day is slightly in excess of the average expenditure by the average peasant family. An estimate of 30 to 40 cents per family was made in the present study. Grant and Groom reported a range of 5 to 27 cents per adult per day for classes living in La Saline.

Table XI shows the costs of some commonly used foods at Cap Haitien and Port-au-Prince markets during the month of July. These are urban markets where prices are often inflated to take advantage of the normally higher income of the urban dwellers. Slightly lower prices prevail in the country markets, especially for fruits and vegetables.

Number and Types of Meals

The average peasant never eats more than two meals per day, not counting the "breakfast." The family rises early and breakfast consists of coffee or a leaf tea sweetened strongly with brown sugar or "rapadou," a heavy, thickened molasses, and a biscuit (30 to 35 gm.) purchased the preceding market day. In addition, the man of the family often drinks about $1/2$ ounce of native rum (clairin).

The next meal usually takes place between 11 A.M. and 3 P.M. when work in the fields has ended. If it is the earlier hour, usually it is quite light and consists of one plantain with a small amount of dried cod fish or herring, or plantain plus a sweet potato, or just a dish of corn plus beans. If work is not completed

TABLE XI

Costs of Some Commonly Used Foods at Cap Haitien and Port-au-Prince Markets During the Month of July*

	Cap Haitien (cents/lb.)	Port-au-Prince (cents/lb.)		Cap Haitien (cents/lb.)	Port-au-Prince (cents/lb.)
Meat and fish:			Cabbage, head	...	7
Beef, regular cuts	20–30	20–25	Cabbage, leaves	3	2
Beef, trimmings	10	12–16	Eggplant	4	4
Cabrit (goat)	...	22	Leek	11	10
Pork	20–32	...	Mirliton leaves	3	3
Fish, smoked	32–42	30	Okra	7–8	5–6
Fish, salted	24–30	22	Peas	6–7	5–6
Fish, fresh	20–40	...	Pumpkin	4–5	6
Cod fish, dried	36	35	Tomato	12	10
Conch, dried	30–45	26	Watercress	10	9
Crabs, fresh	15	18	Fruits:		
Beans:			Apricot	...	3–4
Beans, red	9–10	14–15	Avocado, small	3–4 for 1¢	...
Beans, black	...	12	Avocado, large	...	2
Cereals and cereal products:			Guava	2	2–
			Lime	1	2
Corn	4–5	6	Mango	1	1/2–1
Corn meal	8–10	5	Oranges	...	3
Corn flour	7	10	Pineapple	3–5	4–5
Millet	10	6–7	Nuts:		
Rice	10	12	Cashew, shelled	12	18
Rice, parboiled	10–12	14	Peanuts, unshelled	...	10
Wheat flour	10–12	10	Peanuts, shelled	10	14
Biscuit†	11–16	14–15	Sugars and sweets:		
Macaroni	30	20	Sugar, brown	...	6
Vermicelli	...	20	Sugar, white	...	8
Roots and starchy foods:			Bonbon‡	...	11
Breadfruit	2	3	Douce (candy)§	...	18
Yam (igname)	2	3–6	Tablett (candy)‖	...	18
Yautia (malanga)	4	6	Sugar cane	2–3 ft. for 1¢	...
Potato	10	6			
Sweet potato	2–3	4	Fats and oils:		
Plantain	4	5	Cottonseed oil	32	30
Cassava (manioc)	2	...	Lard	...	28
Cassava bread	...	9	Miscellaneous:		
Fresh vegetables:			Eggs	20–24¢ per doz.	18¢ per doz.
Beans, green	6	6			
Beans, young cut	18	18	Salt, crude	2	1

* Costs were determined by visiting the markets and bargaining with the personnel until what was considered the true market price was obtained. The product was then weighed in order to estimate the cost per pound.

† Small rolls are referred to as "biscuit."

‡ Cake-like pastry of various kinds is referred to as "bonbon."

§ "Douce" is various flavored candies made of milk and sugar.

‖ "Tablett" is a favorite candy of young and old and is made much like peanut brittle. Cashews are often used instead of peanuts.

until 2 to 3 P.M., a much heavier meal is consumed. It may consist of corn, millet or rice with red beans or "bouillon," a favorite dish. The bouillon may contain a small amount of meal, an assortment of vegetables, many wild leaves, and one or more of the "vivres alimentaires" (plantain, sweet potato, yautia and yam). Often a bit of wheat flour dough is added in the form of small balls for "dumplings."

About dark the second meal of the day is eaten. If the lunch is light the second meal will be of the nature of the heavy lunch, that is, it will consist of a cereal with beans or bouillon.

On the other hand, a heavy lunch usually means that the night meal will be light and will consist of a sweetened corn or wheat flour mush, or a baked plantain or sweet potato, or just a cup of leaf tea with a biscuit. Fruits are not normally eaten with meals, except plantain. Mangoes, oranges, grapefruit and avocados are eaten in goodly quantities in season at any time during the day. Sugar cane in season is chewed between meals by nearly all the people in the sugar cane areas. From a caloric standpoint, the daily diet is considerably augmented during the fruit and sugar cane seasons.

Leafy green and yellow vegetables are grown in all areas that were visited, except in the Furcy area where a two-year drought has severely curtailed the production of food. In some areas a definite preference for certain vegetables was noted. For instance, in the Mirebalais area eggplant, cabbage and squash were preferred and used more frequently than other vegetables. This probably is due to the fact that the area is better suited for the production of these crops than for others, and more are available for consumption. Watercress was the preferred vegetable in the diet of persons living where this crop grows profusely near rivers and streams. Naturally, vegetables are seasonal, as are fruits, but the best information is that there are many in season during all times of the year. The average peasant does not buy vegetables often. If he does not produce them, he seldom eats them. The most unusual observation made during the survey was that quantities of wild young green leaves and buds are consumed by the people in all areas. These leaves are listed in Table IV. It is sufficient to say that many types are used. As a group, these leaves are the most important fresh green vegetable in the Haitian diet. Of course, they are used in such quantity because they are an expense-free item of food (except in the cities where they are sold in the markets at a very low price). The composition of these leaves is unknown at the present time, but judging by the composition of known leaves similar to these, there can be little doubt that their consumption in such quantities contributes greatly to the riboflavin and carotene intake of the people.

Preparation of Food

Little effort goes into preparing and cooking the meals in Haiti. One pot over a small, round charcoal burner is used, and into this pot go all ingredients of the meal. With rare exceptions, all foods are boiled. One of these exceptions is the preparation of "Tom-Tom" (baked plantain or sweet potato). In this case a little oil or grease is applied to the plantain or potato and it is put directly on the charcoal fire. After baking, it is then pounded into a flat cake, spices or salt are added, and it is eaten in this form. An alternative Tom-Tom recipe specifies boiled breadfruit, plantain and sweet potatoes reduced to paste consistency in a wooden mortar. This paste is pressed compactly in cloth, cut and eaten with okra bouillon. Also, a salted fish is often prepared by placing it directly over the fire.

The meals always contain a bit of added oil or fat put directly into the pot. When no oil is available, grated coconut meat is put in for its oil content. Fried foods are not prepared in the home. On market days, it is possible for the peasant to obtain a small fried fish (deep fried) for 1 or 2 cents. Rarely does he eat or purchase such an item.

It should be mentioned that little is done to the food prior to its introduction into the pot, except removal of peels from tubers, etc. Of interest is the fact that meat is usually rubbed with juice of the citron (the sour orange) prior to cooking. The same treatment is given one or more of the roots and tubers. The purpose of this treatment was not determined.

Meat (beef, goat and pork) and fish are usually purchased in small amounts only on market days (twice a week in most areas; only once a week in remote areas). The lack of refrigeration makes it imperative that meat be eaten immediately. If the fish is salted, it is usually saved and eaten later in the week. Thus the native dish, "bouillon," may or may not contain animal protein.

Milk is seldom consumed in any quantity by the average family. It is never used as a beverage except for very young children. When it is bought and used by the average family, it is usually added to the "bouillie," the sweetened corn or wheat flour mush. More often this dish is prepared with water or coconut milk.

Eggs are rarely consumed by the peasant class since they are choice marketable items. It was judged that egg production is too small to contribute much to the nutrition of the people of Haiti. Poultry meat is eaten by the average family only a few times a year on certain religious holidays.

Schools and Orphanages, Dietary Information

La Saline, a waterfront district in Port-au-Prince, is composed of families of low economic status. The clinical team conducted physical examinations of children at a public school in this district, and an effort was made to obtain some information on the dietary habits of these children. Children were questioned as to the number of meals they ate each day, what kinds of food they ate and how much. The answers followed such a strict pattern that it was soon realized that the children were not giving information on their own dietary habits but were repeating what had been taught them pertaining to good food habits. The male teacher of the school expressed his opinion that his children seldom ate over one meal per day, and that sugar cane, when it was in season and plentiful, sometimes served as the only nourishment for a day.

Somewhat more definite information was obtained as to the diets of children in La Saline when a visit was made to a day school for girls operated by the Catholic church. There were 250 girls, with an age range of eight to twelve years, attending morning classes at this school. In mid-morning a small roll (25 to 30 gm.) was served each girl, and a lunch was served at noon. A budget of $80.00 was allowed to finance the lunch program for twenty days per month, or about 1.6 cents per girl per day. Obviously, the lunches were quite simple, and usually consisted of corn or millet, red beans and sweet potatoes. The supervising personnel estimated that each child received a daily average of 0.3 pound of millet or corn, 0.2 pound of red beans and 0.2 pound of sweet potatoes. These figures were based on the weekly purchases. A direct observation of meal preparation and the serving of lunch led team members to the conclusion that the daily intake was perhaps one-fourth less than the amounts estimated by the school personnel. Rice was seldom substituted for corn or millet because of its cost, and fresh vegetables were seldom served for the same reason. An effort was made to serve some form of meat, pork or fish, usually as a component of some stew, about once every week or two. The quantities of these products could not be estimated by the supervising personnel.

Although meager by American standards, the lunch program was a strong incentive for attending school. Many girls reported that their school lunches were the only meals they received during the day. A few reported that they received sweetened tea or a cola drink (for an evening meal) in their homes. There is no doubt that nourishment was provided in addition to the school lunch, but perhaps these lunches provided the major portion of the nutrient intake of these girls. By American standards the girls appeared underweight, but their spirits were high, especially before lunch, and their attendance records were excellent. (Clinical examinations were not conducted at this school.) The teachers noted a marked improvement in the performance and alertness of the girls when the school began serving the small roll in mid-morning. Most of the teachers were convinced that 90 per cent of the daily food intake of these girls was provided by the school program.

It was most gratifying to visit a government-operated school for orphan and delinquent boys in the Carrefour area, a suburb of Port-au-Prince, and to observe the facilities for caring for 362 boys ranging in age from about eight to sixteen years. The assistant director and the "cook-dietitian" were most cooperative in discussing the diets used at the school and urged the team members to visit the kitchen and dining area. No records of food purchases were available for examination, but a figure of

22 cents per boy per day was quoted as the budget for food purchases. A visit to the dining area during the lunch hour convinced team members that the boys were receiving ample quantities of food. The lunch consisted of rice, beans, a green leafy vegetable and plantain. The inclusion of a vegetable with a rice and bean meal is an exception in most of Haiti where beans and a cereal, alone, make up a meal. Seldom did we find the inclusion of another food with this type of meal. The cook, who also did all the meal planning, indicated that she had no training in dietetics or nutrition, yet it was evident from her survey of the diets she served that the quality was superior to the average found in Haiti. Milk was served daily in limited amounts (about 150 ml. per boy), yet this is much in excess of the national average. Meat (100 gm. per boy) was served daily except Friday when fish was used. A wide variety of vegetables was used in the meal planning, but fruits were used in a limited way. Again, contrary to the national picture, little sugar and sweets were included in the dietary of these boys. There was no doubt that the diet received by students at this school was far superior to that consumed by boys of comparable ages in the average family in Haiti. Of course the expenditure of 22 cents per boy per day for food would be exorbitant, if not prohibitive, for the average family.

In contrast to the conditions found at the Carrefour school, a struggle to maintain an adequate intake of nutrients was observed at a public orphanage in the suburbs of Port-au-Prince. Here, forty-six children, ranging in age from about two to ten years, were under the care of eight adults. The monthly budget for operation of the institution (excluding salaries) was $200. The food budget depended on the balance remaining after deduction of expenses for soap, charcoal, and transportation for the personnel. In case of emergency, food dollars had to be used for medicines and care of the ill, although normally these expenses would be handled by the government. The supervisor in charge would not make an approximation of her food expenditures for the children, but was sure that the food budget varied tremendously from month to month, depending on other expenses. The eight adults ate their meals at the institution, and thus it was indefinite just how much in terms of quantity or costs could be assessed to each child's food allowance. Perhaps 7 or 8 cents per day would not be unreasonable.

Credit was certainly due the supervisor in view of her efforts to feed the children adequately with such a small budget. She provided three meals per day regardless of circumstances, and seemed aware of the shortcomings as to quality and quantity of certain meals she was forced to serve at times. Fruit, bread with margarine, and milk were served for breakfast when milk could be afforded. If fluid milk was not available, scrambled eggs were served (only twelve for the entire institution), using powdered milk in the process, and the usual bread or two rolls with margarine. Lunch was usually only beans with rice or corn; however, sweet potatoes or a vegetable was sometimes included. The evening meal usually consisted of a meat and vegetable stew (4 to 5 pounds of meat and one or more of the various vegetables) and bread with margarine. Fish was served in place of meat on Fridays. Often the budget prevented the serving of meat during the latter days of the month, in which case vegetable soups were served at the evening meal. Often the children were given a roll and a cup of sweetened tea made from cotton leaves, cinnamon or tibaume prior to going to bed at night. A variety of fruits was given the children for breakfast and occasionally fruit or fruit juice was served between meals. This was one institution that seemed to make full use of the juice of the sour orange, a fruit that is plentiful in Haiti, yet seldom regarded as a useful product. Sweetened with sugar, this juice is very appetizing. By necessity, this institution used several of the wild leaves which can be purchased quite reasonably, and when the food budget permitted, a variety of vegetables was used. Over-all, the quality of the diet at this orphanage was above the national average, but the quantity of food per child appeared very limited.

A parochial orphanage for girls, located near Port-au-Prince, was visited while the clinical team was conducting examinations there.

There were seventy-four girls ranging in age from six to twelve years at this institution. The food budget was approximately 33 cents per girl per day, an amount which was considerably more than allowed the other institutions which were visited. Needless to say, the quantity of food per girl was above the national average, but due to the lack of knowledge of nutritional requirements, there was much to be desired as to the quality of the diets served. Fruits were seldom used in any way, yet there were sour orange trees growing on the grounds of the institution. Mangoes were abundant and cheap, but they had only been given at one meal (a month previous). From the best estimate, the last citrus fruit of any kind had been given the girls two months previously when each received an orange. Usually an effort was made to give a banana to each girl on Sunday, but the importance of fruit in the daily diet was not recognized. Vegetables were usually served as components of soup and seldom were used to balance meals composed mainly of beans and cereal. These vegetable soups, served with bread and butter, were characteristic of the evening meals. Vegetables were not included in meals when meat or fish was served. The girls at this institution were fortunate in having a daily supply of milk, above average quantities of meat, fish and other foods (except fruit), but their diets could have been improved greatly through a better understanding of the essentials of adequate nutrition on the part of personnel in charge of meal planning.

From the few visits made to schools and institutions, it was concluded that nutritional standards could be improved if the services of a trained nutritionist or institutional dietitian could be provided to advise and assist in planning a good nutritional program. The government would profit from such a service in that maximum benefit could be derived from the money allotted these institutions for food. At each institution visited personnel in charge of food services expressed a desire to learn how they could improve the diets of the children. One dietitian for the entire Port-au-Prince area could render a great service to these schools and institutions.

COMMENTS

A careful analysis of food production in Haiti leads to the following general conclusions:

With the exception of three major items (wheat flour, fish, and edible oils), the Republic is or might be made to be self-sufficient with respect to nutritional requirements. The possibility that the requirement for wheat flour will diminish is slight, but the substitution of imported wheat for wheat flour will provide by-products for local use. The plan to enlarge Haitian fisheries, if successful, will help to replace in part the importation of fish and, eventually, to increase the consumption of high quality protein. The situation with respect to edible oils is less promising but any improvement in the production of cotton would alleviate some of the shortage. Studies are in progress to test the possibility of substituting an annual, rapidly maturing cotton (Stoneville 2_B) for the perennial type now in use. The U.N. Mission in 1948 recommended that the African oil palm be introduced in large numbers as a source of oil. No appreciable progress has yet been made in this direction. Small amounts of palm oil are seen occasionally in the local markets.

With respect to other crops, yields can be increased appreciably by means already known. The use of fertilizer and insecticides may be cited. New or improved plant varieties can be introduced. Irrigation, where possible, is known to increase yields as shown in Table XII. Soil conservation and reclamation tech-

TABLE XII

Effect of Irrigation on Yields of Haitian Crops

Crop	Yields	
	Non-Irrigated (lb./hectare)	Irrigated (lb./hectare)
Rice	2,500	5,000
Corn	1,500–2,250	2,500
Millet	1,250	3,750
Cassava	20,000	30,000
Sweet potato	6,500	18,000
Plantain	500 stems	1,700 stems

NOTE: Estimates from the Department of Agriculture of Haiti, Damien.

nics can be adopted. By the use of any or a combination of these methods it is believed that the productivity of Haitian farm land (including livestock) can be greatly increased. However, it is believed that illiteracy and lack of capital are tremendous handicaps to any of these developments. It is obvious that if a farmer cannot read, he is extremely hard to teach. Similarly, if he has no money, he cannot buy fertilizers and insecticides even if he knew enough to do so.

Therefore, two important programs which should be activated immediately are: (1) improved adult and child education and (2): increased rural credit facilities.

The revision of land tenure (discussed in detail by the U.N. Mission) will have to be undertaken at some time in Haiti's future or her farm population pressure will be overwhelming.

With respect to the availability of total food and of the proper kinds of foods, it is believed that here again increased capital and education are paramount. The necessary foods are or can be made to be accessible in the markets. Usually there is not sufficient money to buy, but, even when there is, lack of information on good nutritional practices prevents the proper selection of foods. For his cash crops the peasant will plant what he thinks he can trade to most advantage. Unless he is assured of more money for his bean crop, he does not care to plant beans on the land which he is now using for corn. He does not know that his children will profit more from eating beans than from eating corn. Only combined economic and educational pressures will force the necessary nutritional changes.

The results of this survey show that the Haitian suffers from lack of sufficient food, and that the food he eats is lacking primarily in protein. Providing the necessary increase in calories of any kind is a socioeconomic problem involving land tenure, farm prices, credit, etc. In general, farm production must be increased to meet the need, and the means for doing this are known.

Increasing the protein content of the diet is a more immediate objective. This can be accomplished by increasing the amount and quality of vegetable and cereal proteins, or of meat, eggs, milk and fish. The most available proteins are the dried beans which already form a substantial portion of the Haitian diet. Any increase in this dietary constituent would be of value. Work is required to determine the relative protein values of the red bean, the pigeon pea (pois congo) and the blackeyed pea (pois inconnu), and to work out those mixtures with the popular cereals (corn, millet and rice), which will give maximum utilization of proteins.

Quality of the Haitian Diet

The diet of the average person remains in a relatively fixed pattern. It can be divided into three types of meals: (1) meals in which beans serve as the most important source of protein; (2) meals in which meat serves as the main source of protein; and (3) meals in which fish is the main source of protein.

Type 1 meals are usually higher in protein than the other two types because of the percentage of cereal (corn, millet or rice) that is consumed with the beans. However, the protein quality is poor compared to types 2 and 3. Further, meals of type 1 seldom include any additional class of food, and the absence of green or yellow vegetables and fruits indicates that it is inadequate in calcium and vitamin content (except perhaps thiamine). Thus, from the standpoint of protein quality and vitamin and calcium content, one would conclude that this type of meal is poor nutritionally.

In the type 2 meal, meat is nearly always accompanied by fresh vegetables and leaves and tubers. This meal would be considered the best type of meal consumed in Haiti. The contribution of vitamins and calcium by the vegetables and tubers, along with the high quality protein of the meat, makes this meal much superior to type 1. However, this meal could be improved with the addition of more protein.

Type 3 meals are fish with plantain and perhaps a sweet potato now and then. Because of its protein of good quality, this meal would rank next to type 2 in nutritional value. It is inadequate in vitamins A and C and could be vastly improved with the addition of a fresh fruit or vegetable.

Perhaps it should be said that all three meals could be improved from the caloric standpoint, because in the quantities usually consumed, these meals are probably low in caloric value. One exception might be the cereal plus bean type meal. All three meals are low in fat content.

It must be understood that these three types of meals are not consumed every day. As mentioned previously, meat is eaten soon after market day and before it can spoil, while salted fish is held to be used later in the week. Beans and the cereals appear more frequently in the diet, as they are more or less staples for the family.

In view of the limitations of each type of meal in nutritive value, it might be concluded that the average peasant diet is inadequate in protein (quantity and quality). It is deficient in calories due to its low fat content. The riboflavin content is apt to be very low. Fortunately, the peasant does not have to rely only on these three types of meals for his total nutrient intake. The abundance of fruit in Haiti, especially citrus, mangoes and avocados, plays an important part in the peasant's nutritive condition. He freely partakes of these fruits when in season, at any hour of the day.

Citrus fruits are available in quantities from November through February. Mangoes are in season from June through October. The avocado season lasts for about four months during the summer and early fall. It is only during the spring months that fruits become relatively scarce and too expensive for the average family.

Vitamin C deficiency should be non-existent at least nine months of the year due to the daily consumption of citrus fruits and mangoes. The vitamin A intake should be extremely high during mango season when the peasant may eat 6 to 10 mangoes per day. In other seasons, vitamin A intake may decline, but the use of many green leaves in the diet should prevent any deficiency of this vitamin.

The avocado is a fruit of extreme importance to the peasant diet. Its high fat content and unusually high content of riboflavin make it an ideal fruit to supplement the average diet that is deficient in both of these nutrients. Quantitative information on the daily consumption was sparse, but when avocados are in season, the average peasant will eat 1 to $1^1/_2$ medium sized avocados per day. This is an invaluable addition to his daily riboflavin intake, and adds important amounts of fat. Unfortunately, the season is only three or four months of the year, thus it is likely that borderline and true deficiencies of riboflavin exist in some of the population during other months of the year. It is suspected that the consumption of wild green leaves in such quantities may reduce widespread riboflavin deficiency, since milk and milk products are used very little. The composition of these various leaves is not known at present, but it is known that wild leaves (especially the dark green ones) in other countries contain relatively large amounts of riboflavin. The possibility also exists that one or more of the frequently used species in Haiti could be unusually high in riboflavin content.

Thus, judging from the types of meals consumed in the average peasant family and the various fruits that are eaten between meals, the daily nutrient intake is no doubt low in protein (quantity and quality) and low in fat and calories. The vitamin intake may be satisfactory most of the year, except for riboflavin. The calcium and iron intake, while not high, may be adequate to prevent deficiencies of these two elements.

Improvement of the Diet

It would be simple to say that the daily diet could be improved by the addition of more meat, milk, eggs and fat, and that the peasant should have his fruit juice for breakfast every day of the year. Such suggestions are of little value to a population with such limited income and such fixed dietary habits. More meat and fish would be consumed if the people could afford them. Many peasants expressed a desire to give milk to their children but were financially unable to do so. However, the adult population would not be apt to use milk or milk products even if money were

TABLE XIII
Frequency of Evidence of Malnutrition

Analysis	Questionable Ranges (Less Than)	% of Population in Questionable Range
Total plasma protein	6.4 gm./100 ml.	15
Plasma albumin	3.9 gm./100 ml.	55
Hemoglobin	12 gm./100 ml.	13 (33, of pregnant women)
Plasma ascorbic acid	0.2 mg./100 ml.	8
Plasma vitamin A	20 μg./100 ml.	7
Plasma carotene	40 μg./100 ml.	2
Urinary thiamine	66 μg./gm. creatinine	29
Urinary riboflavin	80 μg./gm. creatinine	2
Urinary *N*-methyl nicotinamide	1.6 mg./gm. creatinine	19

available. An improvement in poultry breeds and production might well lower the cost of poultry and eggs to the point where the average family could purchase more. It would also be helpful if more families could raise their own poultry and eggs and would not have to rely on ready cash for the purchase of animal protein.

If the peasant could be encouraged to change his dietary pattern, he could improve his diet and nutritive status without increasing his food budget. The corn, millet, rice and beans type of meal could be improved by the addition of fresh vegetables or leaves. It would be further improved if just a little of the meat of type 2 meals were included in this meal. Likewise, type 3 meals would be greatly improved if the fish and tubers or plantain were supplemented with a green vegetable. Meat meals of type 3 would be improved from the calorie standpoint by addition of cereal to the meal.

In view of the nutritional value of the avocado, the peasant should be encouraged to eat this fruit regularly and in quantity during the months that it is available. The use of avocado as a regular component of daily meals might be a good way of insuring that all members received an adequate portion and might establish a pattern of eating fruits along with the three types of meals.

To insure against vitamin C deficiency during the early spring months, or when the fruit supply is low, the use of fruit jellies could be recommended. The goyave jelly is easily prepared and contains substantial quantities of vitamin C. This jelly and others could be prepared during the fruit seasons and saved for use in the months when vitamin C intake is apt to be low.

BIOCHEMICAL EXAMINATIONS*

Methods

Blood and urine samples were obtained from 454 persons, approximately 15 per cent of those examined. The selection of individuals from whom these specimens were obtained was not uniform because of varied circumstances. There was usually an attempt at random sampling, i.e., every tenth person was examined. In a few instances samples were requested in order to attempt individual correlations with clinical findings. All blood samples were drawn by a Haitian physician. A sample of 20 ml. of venous blood was drawn from each person selected for biochemical examination. The blood was collected in a "vacutainer" tube containing 40 mg. of Heller and Paul oxalate mixture. The blood samples were transported on a daily schedule to the laboratory in Port-au-Prince for analysis.

In addition, urine samples were collected in plastic bottles and a 30 to 50 ml. aliquot

* The biochemical laboratory team included B. L. Reid, G. P. Barron, G. L. Brinkman, J. Foucault, K. W. King, S. C. Smith and F. Vital.

was transferred to a brown bottle containing approximately 50 mg. of oxalic acid and 0.1. ml. of hydrochloric acid.

All samples were placed in insulated cans and packed with ice for transportation to the base laboratory. All blood analyses were completed the following day—delays in the arrival of equipment made it necessary to store the urine samples in a freezer. The maximum storage time for the samples obtained during the first two weeks of the survey was one to two weeks, after which time all analyses were completed within one day after collection. Since fasting urine samples were not feasible under the conditions of the study, all urine values were expressed on a per gram of creatinine rather than on a time basis.

The laboratory procedures employed are detailed in the ICNND Manual for Nutrition Surveys (revised 1957 edition). The low creatinine content in a number of samples made it advisable to use 0.2 ml. of urine for this determination. The N'methylnicotinamide method was performed as outlined except that all urine samples were decolorized with charcoal before analysis. The plasma vitamin C level was estimated by the use of the 2,6 dichlorobenzenone indophenol procedure.

The acid hematin method was used for the estimation of hemoglobin content, with the iron determination of Wong (*J. Biol. Chem.*, 77: 409, 1928) being employed to standardize the procedure. Plasma protein and albumin were determined by the biuret reaction employing the procedure of Wolfson (*Am. J. Clin. Path.*, 19: 723–730, 1948).

TABLE XIV
Summary of Biochemical Findings (All Locations)

Total Plasma Protein (gm./100 ml.)

Range	<6	6–6.4	6.5–7.0	>7.0	Total
No.	24	42	70	318	454
%	5.3	9.3	15.4	70.0	100

Plasma Albumin (gm./100 ml.)

Range	<3	3.0–3.9	4.0–5.0	>5.0	Total
No.	37	195	164	25	421
%	8.8	46.3	39.0	5.9	100

TABLE XIV (*Continued*)

Hemoglobin (gm./100 ml.)

Range	<10	10.0–10.9	11.0–11.9	12.0–13.9	14.0–14.9	15+	Total
No.	12	13	20	97	69	145	356
%	3.4	3.6	5.6	27.2	19.4	40.8	100

Mean Cell Hemoglobin Concentration (gm./ml. packed cells) × 100

Range	<28	28.0–29.9	30.0–33.9	34.0 +	Total
No.	9	7	81	238	335
%	2.7	2.1	24.2	71.0	100

Plasma Vitamin C (mg./100 ml.)

Range	<0.10	0.10–0.19	0.20–0.39	0.40+	Tota
No.	20	13	38	339	410
%	4.9	3.2	9.3	82.6	100

Plasma Vitamin A (μg./100 ml.)

Range	<10	10–19	20–49	50+	Total
No.	1	20	170	96	287
%	0.3	7.0	59.3	33.4	100

Plasma Carotene (μg./100 ml.)

Range	<20	20–39	40–99	100+	Total
No.	0	7	86	258	351
%	0.0	2.0	24.5	73.5	100

Urinary Thiamine (μg./gm. creatinine)

Range	<27	27–65	66–130	130+	Total
No.	41	88	113	199	441
%	9.3	20.0	25.6	45.1	100

Urinary Riboflavin (μg./gm. creatinine)

Range	<27	27–79	80–270	270+	Total
No.	2	5	142	302	451
%	0.4	1.1	31.5	67.0	100

Urinary N'-Methyl Nicotinamide (mg./gm. creatinine)

Range	<0.5	0.5–1.59	1.6–4.3	4.3+	Total
No.	9	75	233	136	453
%	2.0	16.6	51.4	30.0	100

TABLE XV—Biochemical Findings by Per Cent of Standard Body Weight

	Standard Weight Range					
	<70%	70–79%	80–89%	90–99%	100–109%	110%+
Plasma protein (gm./100 ml.)	Number of Determinations					
	14	73	163	143	50	17
	Per Cent Distribution					
<6	7.1	5.5	4.3	6.2	6.0	6.2
6–6.4	0.0	8.2	6.1	9.7	18.0	6.2
6.5–7.0	7.1	4.1	14.1	14.6	30.0	31.3
7.0+	85.8	82.2	75.5	69.5	46.0	56.3
Plasma albumin (gm./100 ml.)	Number of Determinations					
	10	69	131	133	46	16
	Per Cent Distribution					
<3.0	41.7	14.5	8.3	5.3	10.9	0.0
3.0–3.9	24.9	42.0	48.9	45.1	69.5	43.8
4.0–5.0	33.4	37.7	35.9	41.4	17.4	56.2
5.0+	0.0	5.8	6.9	8.2	2.2	0.0
Hemoglobin (gm./100 ml.)	Number of Determinations					
	10	67	121	114	40	13
	Per Cent Distribution					
<10	10.0	4.5	2.5	3.6	...	7.7
10.0–10.9	10.0	...	4.1	5.4	5.0	...
11.0–11.9	...	4.5	6.6	5.4	5.0	...
12.0–13.9	10.0	35.8	23.1	31.5	27.5	23.1
14.0–14.9	30.0	19.4	24.0	14.4	12.5	23.1
15+	40.0	35.8	39.7	39.7	50.0	46.1
Mean cell hemoglobin concentration	Number of Determinations					
	10	64	111	109	37	13
	Per Cent Distribution					
<28	...	1.5	2.7	2.7	2.7	7.7
28.0–29.9	...	...	1.8	2.7	...	7.7
30.0–33.9	30.0	32.8	20.7	22.0	21.6	...
34.0+	70.0	65.7	74.8	72.6	75.7	84.6
Plasma vitamin C (mg./100 ml.)	Number of Determinations					
	12	71	132	132	42	15
	Per Cent Distribution					
<0.10	8.3	2.8	6.8	3.0	7.1	0.0
0.10–0.19	8.3	4.2	3.0	3.8	2.4	0.0
0.20–0.39	33.4	12.7	6.1	9.2	4.8	6.3
0.40+	50.0	80.3	84.1	84.0	85.7	93.7

TABLE XV (*Continued*)

Plasma vitamin A (μg./100 ml.)	Number of Determinations					
	8	59	108	85	30	8
	Per Cent Distribution					
<10	0.0	0.0	0.0	1.6	0.0	0.0
10–19	25.0	10.2	8.3	4.6	3.3	0.0
20–49	50.0	49.0	60.1	40.5	73.4	45.5
50+	25.0	40.8	31.6	33.3	23.3	54.5
Plasma carotene (μg./100 ml.)	Number of Determinations					
	11	67	129	105	32	9
	Per Cent Distribution					
<20	0.0	0.0	0.8	0.9	0.0	0.0
20–30	0.0	1.5	1.5	1.9	3.2	0.0
40–99	45.5	31.3	17.0	15.5	37.5	11.1
100+	54.5	67.2	80.7	81.7	59.3	88.9
Urinary thiamine (μg./gm. creatinine)	Number of Determinations					
	12	79	164	131	47	16
	Per Cent Distribution					
<27	8.3	12.6	7.3	7.5	8.6	25.0
27–65	16.6	22.8	18.3	17.6	25.5	18.7
66–130	50.0	20.3	53.8	23.7	25.5	37.5
130+	25.1	44.3	50.6	51.2	40.4	18.8
Urinary riboflavin (μg./gm. creatinine)	Number of Determinations					
	11	75	161	136	51	15
	Per Cent Distribution					
<27	0.0	0.0	0.6	0.0	0.0	6.7
27–79	0.0	0.0	2.5	0.7	0.0	0.0
80–270	7.7	33.6	32.9	30.9	31.4	33.0
270+	92.3	65.4	64.0	68.4	68.6	60.3
Urinary-N′-methylnicotinamide (mg./gm. creatinine)	Number of Determinations					
	14	79	156	135	50	15
	Per Cent Distribution					
<0.5	0.0	3.8	2.6	0.7	2.0	0.0
0.5–1.59	14.2	17.7	17.3	14.9	20.0	20.0
1.6–4.3	42.9	46.9	50.7	53.0	54.0	40.0
4.3+	42.9	31.6	29.4	31.4	24.0	40.0

TABLE XVI

Summary of Biochemical Findings by Location*

	Location												
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Total or Average
	Number of Determinations												
Plasma protein (gm./100 ml.)	11	41	54	21	33	38	70	39	59	14	44	30	454
	Per Cent Distribution												
<6	...	9.8	1.8	4.8	9.8	...	...	5.1	3.4	7.1	22.7	...	5.3
6–6.4	...	9.8	9.3	9.5	3.2	...	4.3	7.7	3.4	42.8	15.9	30.0	9.3
6.5–7.0	18.2	31.6	18.5	9.5	3.2	21.1	8.6	...	6.8	28.6	27.3	26.6	15.4
7.0+	81.8	48.8	70.4	76.2	84.8	78.9	87.1	87.2	84.4	21.5	34.1	43.4	70.0
	Number of Determinations												
Plasma albumin (gm./100 ml.)	12	48	71	21	32	36	67	40	55	15	44	...	441
	Per Cent Distribution												
<3.0	...	8.3	9.8	19.0	9.4	11.1	1.5	7.5	12.7	...	13.6	...	8.8
3.0–3.9	58.4	56.2	54.8	42.7	75.0	52.7	17.9	22.5	41.7	60.0	63.6	...	46.4
4.0–5.0	41.6	35.5	35.4	38.3	15.6	36.2	55.2	50.0	45.6	40.0	22.8	...	39.0
5.1+	...	...	...	...	...	...	25.4	20.0	...	...	...	...	5.8
	Number of Determinations												
Hemoglobin (gm./100 ml.)	11	19	34	19	31	26	60	31	54	14	35	22	356
	Per Cent Distribution												
<10	...	5.3	...	...	...	...	1.7	3.2	14.8	...	...	4.5	3.4
10.0–10.9	...	5.3	...	5.3	...	7.7	8.3	9.7	1.9	...	...	...	3.6
11.0–11.9	...	10.5	5.9	5.3	9.7	3.8	5.0	6.5	7.4	...	5.7	...	5.6
12.0–13.9	...	10.5	23.5	15.8	25.8	30.8	33.3	29.0	22.2	71.4	25.3	36.4	27.2
14.0–14.9	18.2	5.3	32.4	26.4	12.9	34.6	20.0	9.7	18.5	14.3	4.4	27.2	19.4
15.0+	81.8	63.1	38.2	47.2	51.6	23.1	31.7	41.9	35.2	14.3	57.2	31.9	40.8
	Number of Determinations												
Mean cell hemoglobin concentration	12	18	31	19	31	26	60	31	38	14	35	20	335
	Per Cent Distribution												
<28	...	5.6	...	...	...	...	1.7	...	18.4	...	...	...	2.7
28.0–29.9	...	11.1	...	...	3.2	...	1.7	...	2.6	...	2.9	5.0	2.1
30.0–33.9	16.6	16.6	6.5	26.3	29.1	23.1	33.3	41.9	26.3	21.4	17.1	10.0	24.2
34.0+	83.4	66.7	93.5	73.7	67.7	76.9	63.3	58.1	52.7	78.6	80.0	85.0	71.0
	Number of Determinations												
Plasma vitamin C (mg./100 ml.)	12	40	53	20	34	38	64	39	56	11	33	10	410
	Per Cent Distribution												
<0.10	16.7	2.5	1.9	10.0	14.7	2.6	3.1	...	7.1	9.1	3.0	...	4.9
0.10–0.19	...	2.5	1.9	5.0	11.8	2.6	...	2.6	5.3	...	3.0	...	3.2
0.20–0.39	25.0	5.0	7.5	5.0	5.9	13.2	1.6	18.0	8.9	27.3	15.2	...	9.3
0.40+	58.3	90.0	88.7	80.0	67.6	81.6	95.3	79.4	78.7	63.6	78.8	100.0	82.6

* Table I shows the identification of locations.

TABLE XVI (*Continued*)

	Location												
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Total or Average
	Number of Determinations												
Plasma vitamin A (μg./100 ml.)	...	28	33	21	30	12	63	35	50	...	15	...	287
	Per Cent Distribution												
<10	...	...	3.0	...	...	...	...	...	...	...	...	...	0.3
10–19	...	21.4	6.1	19.0	13.3	...	1.6	5.7	2.0	...	...	...	7.0
20–49	...	57.2	63.6	57.2	66.7	75.0	44.4	60.0	58.0	...	93.3	...	59.3
50+	...	21.4	27.3	23.8	20.0	25.0	54.0	34.3	40.0	...	6.7	...	33.4
	Number of Determinations												
Plasma carotene (μg./100 ml.)	...	29	52	21	32	38	70	39	56	...	14	...	351
	Per Cent Distribution												
<20	...	...	...	...	...	...	...	...	...	...	...	...	0.0
20–39	...	...	1.9	4.8	3.1	...	1.4	...	5.4	...	...	...	2.0
40–99	...	31.0	25.0	23.8	34.4	18.4	5.7	25.6	42.8	...	21.4	...	24.5
100+	...	69.0	73.1	71.4	62.5	81.6	92.9	74.4	51.8	...	78.6	...	73.5
	Number of Determinations												
Urinary thiamine (μg./gm. creatinine)	20	41	57	19	38	32	63	42	59	14	29	27	441
	Per Cent Distribution												
<27	20.0	17.1	7.0	...	...	...	...	14.3	27.2	...	6.9	7.4	9.3
27–65	55.0	19.5	22.8	10.5	5.3	18.8	6.4	21.4	32.2	...	31.0	18.4	20.0
66–130	10.0	22.0	28.1	36.9	26.3	43.7	20.6	33.3	20.3	...	20.7	37.1	25.6
130+	15.0	41.4	42.1	52.6	68.4	37.5	73.0	31.0	20.3	100.0	41.4	37.1	45.1
	Number of Determinations												
Urinary riboflavin (μg./gm. creatinine)	20	42	57	21	37	37	67	37	58	14	35	26	451
	Per Cent Distribution												
<27	...	...	...	...	...	...	...	...	...	...	...	7.7	0.4
27–79	10.0	2.4	...	...	...	...	...	...	...	...	...	7.7	1.1
80–270	70.0	23.8	40.3	28.6	16.2	21.6	13.4	56.8	39.7	...	28.6	46.2	31.5
270+	20.0	73.8	59.7	71.4	83.8	78.4	86.6	43.2	60.3	100.0	71.4	38.4	67.0
	Number of Determinations												
Urinary-N′-methyl nicotinamide (mg./gm. creatinine)	20	43	58	19	38	39	65	36	60	14	35	26	453
	Per Cent Distribution												
<0.5	...	...	1.7	...	...	...	...	2.8	11.7	...	...	...	2.0
0.5–1.59	5.0	25.6	19.0	21.1	7.9	2.6	23.1	36.1	13.3	...	14.3	11.5	16.6
1.6–4.3	70.0	55.7	55.2	57.8	42.1	59.0	50.8	36.1	55.0	21.4	45.7	57.6	51.4
4.3+	25.0	18.7	24.1	21.1	50.0	38.4	26.1	25.0	20.0	78.6	40.0	30.9	30.0

TABLE XVII
Hemoglobin Levels in Females

Range of Values (gm./100 ml.)	Non-Pregnant				Pregnant	
	All Ages		Older Than 18 Yr.			
	No.	%	No.	%	No.	%
<10	6	3.4	6	4.8	2	7.4
10.0–10.9	7	3.9	5	4.0	4	14.8
11.0–11.9	10	5.6	10	8.0	3	11.2
12.0–13.9	65	36.2	44	35.2	10	37.0
14.0–14.9	42	23.5	30	24.0	4	14.8
15+	49	27.4	30	24.0	4	14.8
Total	179	100.0	125	100.0	27	100.0

NOTE: Per cent with hemoglobin <12.0 gm./100 ml.: non-pregnant, all ages, 12.9; non-pregnant, older than 18 years, 16.8; pregnant, 33.3.

Both thick and thin blood smears were examined for the presence of malaria parasites.

Mean cell hemoglobin concentration (M.C.H.C) was calculated from hematocrit readings as follows:

$$\frac{\text{gm. hemoglobin per 100 ml. of blood}}{\text{volume of packed cells, ml. per 100 ml. of blood}} \times 100 = \text{M.C.H.C.}$$

Table XIII summarizes the biochemical evidence of potential nutritional problems. Shown here are the percentages of the total sample in the two lower ranges used by the ICNND, called "deficiency" and "low." This grouping was examined in order to reveal the portion of the population that was on a marginal plane of nutrition, and therefore most susceptible to suffering frank deficiency in the event of crop failure or an economic crisis. Total protein, albumin, thiamine and niacin are most striking here with incidences greater than 15 per cent. Ascorbic acid and vitamin A, however, also appear to pose a potential threat with incidences greater than 5 per cent. The frequency of low hemoglobin merits attention in this same regard.

Tables XIV to XVIII present the detailed biochemical findings.

CLINICAL STUDIES*

During twenty-four days in June 1958, four physician members of the survey team performed standard physical examinations on 3,113 Haitians. Tables I and XIX give the locations and distribution of the population studied. There was no attempt to select representative samples of communities, schools, or dispensary patients. Presence in the dispensaries or schoolrooms was the determining factor for inclusion of all subjects. The data concerning personal identity, age, height and weight were recorded by two Haitian nurses. Blood and urine specimens were obtained by a Haitian physician and nurse from almost 15 per cent of the subjects in the study.

Body Weight

The deviations in weight from American and British standards are presented in Table XX. The standards employed were as follows:

(1) For males twenty to thirty years old, the tables in the Manual published by the Interdepartmental Committee of Nutrition for National Defense.

(2) For older males and for females over

* The clinical examinations were performed by W. H. Sebrell, Jr., E. L. Severinghaus, J. Bernadotte, H. Delva and W. Fougere.

TABLE XVIII

Malaria Incidence (By Locations)

Location	No. Samples	No. Positive	% Positive
Port-au-Prince Hospital	28	0	0
La Saline	12	0	0
Guilloux School	10	0	0
Venezuela School	12	0	0
Petionville Center	15	0	0
Petionville School	18	0	0
Orphanages P.A.P.	12	0	0
Carrefour Center	14	0	0
Carrefour School	17	0	0
Kenscoff Center	13	0	0
Kenscoff School	10	0	0
Mirebalais Center	19	1*	5.3
La Boule	20	0	0
Croix-des-Bouquets	15	1†	6.7
Furcy	23	1†	4.4
Schweitzer Hospital (Deschapelles)	41	3†	7.3
Gonaives	22	1†	4.6
Pont de l'Estere	20	0	0
Gros Morne	18	7†	38.8
Cap Haitien Hospital	20	1	5.0
Limbe	20	1†	5.0
Limonade	22	3†	13.6
St. Raphael	18	1†	5.6
Cap Haitien Center	20	0	0
Trou du Nord	29	0	0
Totals	468	20	4.3

* Quartan. † Falciparum.

TABLE XIX

Composition of Sample*

Ages (yr.)	Sex	
	Male	Female
5–9	252	231
10–19	535	727
20–29	202	400
30–39	119	281
40–49	68	146
50–59	58	64
60–69	31	37
70–79	5	13
80–89	2	2
90–99	1	0
Totals	1,273	1,901
Rural	720	1159
Urban	553	742

NOTE: Of those aged 5 to 19 years, 699 males and 786 females were in schools.

* This tabulation includes 61 persons, records from which were deleted from final study because of incompleteness or suspected errors.

the age of eighteen, Tables A and B from "Body Weight at Different Ages and Heights," by W. F. F. Kemsley, *Annals of Eugenics*, 16, part 4, pp. 316–334, 1952. (British data on 61,077 persons examined in 1943.)

(3) For males five to nineteen years old, and for females five to eighteen years old, the Baldwin-Wood Tables 36 and 37 in "Heights and Weights of Children in the United States," *Home Economics Research Report No. 2*, U. S. Department of Agriculture, October, 1957.

It is apparent that the most common finding is weight 80 to 90 per cent of standard, but that 90 to 100 per cent is almost as common. Obesity, i.e., weight more than 10 per cent above standard, was almost as uncommon as striking leanness, i.e., more than 30 per cent below standard. One might observe that 83 percent of the entire group weighed less than the standards used, and more than 51 per cent were below 90 per cent of standard.

Notable for deviation from this pattern are the populations in locations II, X, XI and XII. These are obviously the economically more favorable communities and schools of children from better homes, or in a well managed home for orphans. It is, therefore, not surprising to find the weight values in higher brackets in these four locations.

Only three emaciated or cachectic persons were recorded in the total sample.

Skinfold Thickness

Examination of Table XXI shows that the skinfold thickness on the arm tends to increase in the second decade. There is little progressive increase during the third and fourth decades. The frequency of low values diminishes progressively during this span of forty years. However, after forty there is an abrupt

TABLE XX

Geographic Distribution of Body Weight

Location	No. Examined	% of Standard Body Weight					
		70	70–79	80–89	90–99	100–109	110+
I	151	4.1	17.3	44.8	21.4	7.2	5.2
II	297	1.0	6.1	32.5	35.2	18.8	6.4
III	361	2.8	13.6	38.2	29.8	12.4	3.2
IV	132	3.6	6.8	37.2	34.0	15.2	3.2
V	229	3.6	20.6	43.2	24.2	6.6	1.8
VI	309	3.2	16.5	42.1	26.5	9.1	2.6
VII	354	3.7	16.4	43.0	27.5	8.3	1.1
VIII	189	0.9	20.7	30.7	32.9	10.0	4.8
IX	325	3.4	12.9	33.6	25.5	14.4	10.2
X	99	1.0	6.0	34.4	42.4	15.2	1.0
XI	382	0.3	2.9	36.4	43.7	14.9	1.8
XII	285	1.0	6.0	31.6	33.6	20.8	7.0
Total	3,113	2.3*	11.9	37.1	31.7	13.0	4.0

Note: Values are the per cent of sample at each location.
* This and numbers to right represent averages.

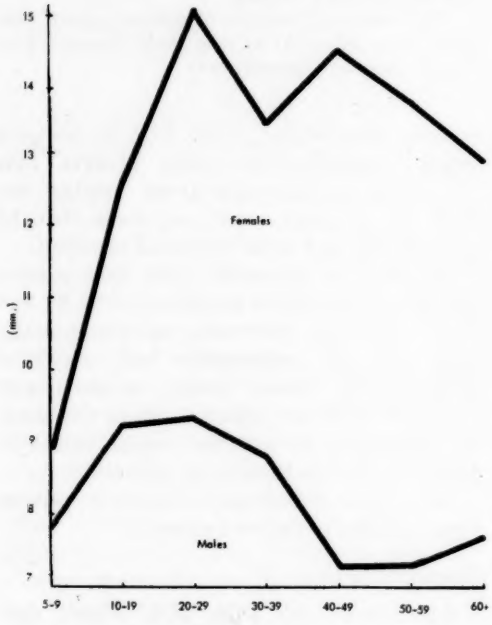


FIG. 1. Change of skinfold thickness on arm with age (medians). Abscissae—Age in years.

but sustained decrease in the skinfold thickness in males. This is manifested by a larger proportion of measurements below 5 mm., fewer above 10 mm., and the absence of observations above 15 mm.

The data on females follow a similar course in part, but with the following exceptions: (1) Preadolescent values are slightly larger. (2) During the second decade the increased subcutaneous fat layers are more apparent in the females than in the males. (3) Third decade measurements show a progressive increase in fat. (4) Regression to less arm fat is not shown until the seventh decade.

In Figure 1 these data are condensed graphically. The median for males remains below 10 mm., and only seven measurements were as great as 20 mm. The median for females is between 12 and 15 mm. after the age of nine. Measurements of 20 mm. or more were recorded in 12.7 per cent of all females, of 25 mm. or more in 4.9 per cent, and of 30 mm. or more in 1.6 per cent.

It was hoped that observations on skinfold thickness might provide a better criterion for obesity than per cent deviation from weight predicted by actuarial standards based on North American or British data, applied to a different racial group in a different cultural environment. Our data are presented in Table XXII for such correlations. The

TABLE XXI

Skinfold Thickness by Age and Sex

Skinfold (mm.)	Age (yr.)										
	5–9	10–19	20–29	30–39	40–49	50–59	60–69	70–79	80–89	90+	Totals
1,268 Males											
1–4	12.7	6.0	3.9	1.7	23.9	22.4	32.2	20	50	0	115
5–9	66.8	52.0	55.0	64.0	56.9	60.3	38.8	20	50	0	721
10–14	19.1	36.3	33.6	29.3	19.2	17.3	29.0	20	0	100	377
15–19	0.8	5.1	5.5	5.0	0	0	0	40	0	0	48
20+	0	0.6	2.0	0	0	0	0	0	0	0	7
1,894 Females											
1–4	7.8	0.5	0.5	1.4	2.7	0	11.1	0	0	0	36
5–9	54.1	27.8	12.1	21.0	19.2	20.3	19.4	23.0	0	0	484
10–14	32.5	41.3	37.5	38.5	32.2	40.6	38.8	38.5	50	0	725
15–19	4.7	23.5	30.6	21.0	19.8	15.6	14.0	30.8	0	0	408
20–24	0.9	5.9	12.9	10.0	15.8	11.0	11.1	0	50	0	159
25–29	0	0.9	5.1	3.5	5.5	7.8	2.8	0	0	0	51
30–34	0	0.1	0.8	3.5	3.4	4.7	0	7.7	0	0	23
35–39	0	0	0	0.7	0.7	0	0	0	0	0	3
40+	0	0	0	0.5	0.4	0.7	0	2.8	0	0	5

NOTE: Values are the % of sample in each age group.

TABLE XXII

Skinfold Thickness as Related to Standard Weight

Skinfold (mm.)	% of Standard Weight										
	60–69	70–79	80–89	90–99	100–109	110–119	120–129	130–139	140–149	150+	Totals
1,268 Males											
1–4	12	24	53	22	4	0	0	0	0	0	115
5–9	4	97	327	236	47	8	1	0	0	1	721
10–14	1	22	132	161	55	4	1	1	0	0	377
15–19	1	1	12	17	14	1	2	0	0	0	48
20+	0	0	1	3	2	1	0	0	0	0	7
1,894 Females											
1–4	7	10	11	3	1	1	0	0	2	1	36
5–9	15	104	222	106	26	7	0	0	0	4	484
10–14	19	98	279	226	100	9	1	0	0	2	725
15–19	4	18	109	164	88	17	4	2	1	0	408
20–24	0	4	24	54	49	21	4	2	1	1	159
25–29	0	0	0	10	19	15	5	2	0	0	51
30–34	1	0	2	3	4	2	7	1	3	0	23
35–39	0	0	0	0	0	0	0	2	0	1	3
40+	1	0	0	0	0	0	2	1	1	0	5

NOTE: Values are number of individuals.

TABLE
Stature Distribution

Age (yr.)	Stature in																		
	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53
5				1		5	3	2	2	2	2	2	1		1					
6	1	1	1			3	4	6	2	5	9	6	12	10	7	9	1	2	1	
7					1		4	1	3	1	5	6	8	10	5	7	2	1		
8								1	1	2	3	4	4	7	3	4	10	3	1	2
9												2	3	7	9	4	9	8	6	3
10													2	1	4	15	11	16	13	13
11															2	3	6	9	9	11
12															3	2	4	5	9	12
13																		1	2	
14																				2
15																				
16																				
17																				
18																				
19																				
20–29																				
30+																				

NOTE: Values are number of persons.

male group does show more individuals with less than 5 mm. skinfold thickness in those with weights less than 100 per cent of predictions. There is, however, no progression toward thinner arms below the 80 per cent group. The slight trend toward progressive increase in frequency of skinfold measurements from 15 mm. up seen with increasing relative weights is probably not a useful criterion. This increase begins to appear in the 80 to 89 per cent weight group, but the number of persons with this characteristic is too small above 110 per cent relative weight to provide any assurance in use of such skinfold data beyond mere confirmation of the height-weight-age-sex classifications. There may be a "break-point" in male skinfold thickness which provides a criterion for obesity, superior to conventional methods, but we cannot identify such a figure from our data.

The comparisons of skinfold measurements with weight in females are not apparently too helpful, for similar reasons. The trends toward little fat in the arms of females as weight decreases below 100 per cent and to skinfold thickness of 20 mm. or more as weights go upward from 80 per cent are more obvious than the parallels in males. Search for a "break-point" indicative of obesity is unrewarding in two ways: employing 30 mm. as such a point would identify as obese seven who are below the 100 per cent weight level (not theoretically impossible) but it would also fail to identify thirty-two who are more than 20 per cent overweight.

In Figure 2 are seen the medians of per cent

XXIII*
of Males by Age

Inches

54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74
	1																			
11	9	3	3		1	1	1													
12	8	10	7	9	1	2														
8	8	4	15	9	13	1	3	2	1											
6	8	12	7	9	10	3	4	2		1	1									
2	3	2	2	2	5	8	2	4	5			1		2						
	1		4	2	2	4	3	5	1	6	1	3	3	3						
			1		3	2	1	5	5	4	3	4		1						
						3	3	5	2	5	5	3	1	3						
						1	1	2	3		5	1	7		1					
							1	2	3		1	2	5		2	2			1	
						4	5	12	16	18	21	32	32	26	18	8	66	3	1	
				3		4	3	12	22	23	31	43	35	36	31	21	13	6		1

weight deviation plotted against arm skinfold thickness, together with the lines representing first and third quartiles. Although the continuous progression of values is fairly regular and strikingly similar for the sexes, the wide divergences between medians and quartiles suggests limited authenticity for any prediction of relative weight from the measurement of arm skinfold thickness.

We conclude that the use of skinfold thickness measurement must be carried forward by other means of tabulation and correlation before it can become a substitute for relative weight as a criterion of obesity.

The measurement of skinfold thickness with standardized calipers confirmed these observations by showing uncommonly an appreciable amount of subcutaneous fat in the arm or subscapular areas. The Haitian population can be characterized as slender, muscular, and of a strikingly wide variety of stature.

Stature

The distribution of statures by ages is shown in Tables XXIII and XXIV. The extensive scatter of values at a given age is apparent. A graphic representation of the medians and first and ninth deciles is given in Figures 3 and 4. The striking frequency of very short children and adults may be stressed.

PHYSICAL FINDINGS

In Table XXV are presented the occurrence (in per cents) of various physical findings for the 3,113 subjects, of which 1,800 were female.

The frequency of palpable enlargement of

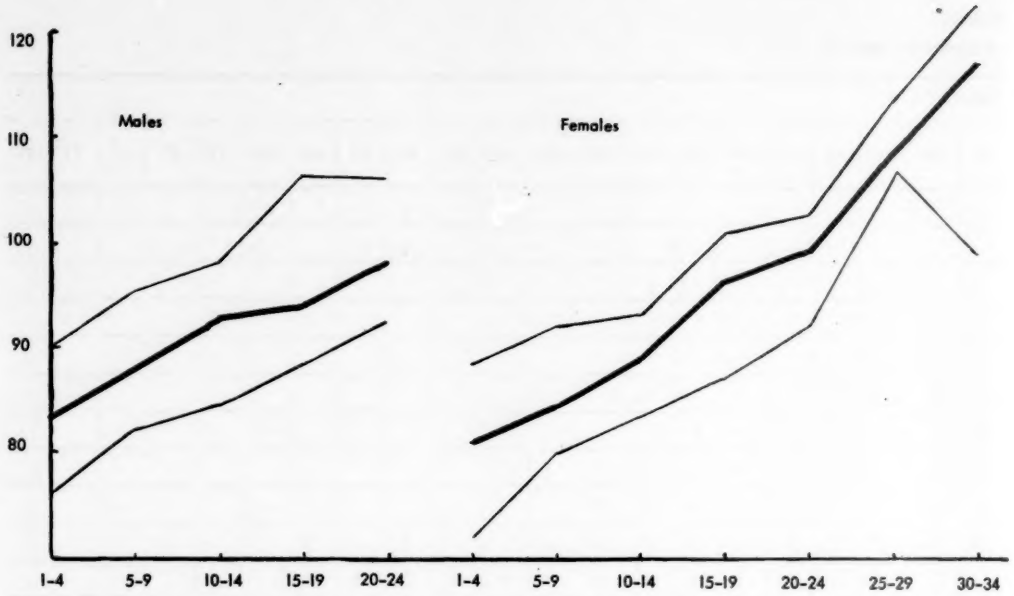


FIG. 2. Prediction of per cent weight deviation from standard by arm skinfold thickness. Medians with first and third quartiles. Abscissae—mm. skinfold. Ordinates—per cent of standard weight.

thyroids, greater in females in Haiti than elsewhere, was surprising. The figures range from 17.5 to 39 per cent for all females, omitting only the girls in the orphans' home, most of whom were under fifteen years of age. Among males the figures vary from 1.4 to 16 per cent. The goiters were rarely obvious on inspection. General use is made of poorly refined sea salt. One sample of this salt was analyzed, showing only a trace of iodine. However, this salt undergoes much exposure to sun and air prior to use, and the iodine is probably lost during this interval.

Enlarged parotid glands were frequently obvious on inspection as well as palpation. This was uniformly far more striking in males.

Impressively high frequency is recorded for follicular keratosis of skin (10 to 31 per cent), crackled skin (21 to 83 per cent), and for thickened conjunctivas (9 to 81 per cent) and pingueculas. Bitot's spots were seen in many cases (5 per cent). Whereas all these signs suggest a long standing deficient supply of vitamin A, we were also impressed with the factor of exposure to dirt and weather. These findings were minimal in younger subjects. Crackled skin on legs occurred less severely and less frequently in the urban groups with better clothing and less contact with soil and less trauma to legs. It would be difficult to escape the impression of frequent suboptimal intake of vitamin A.

Correlations between eye and skin lesions and blood levels of carotene or of vitamin A are shown in Table XXVI. No satisfaction is obtained by attempts to correlate vitamin levels with the data concerning thickened conjunctivas or pingueculas. Bitot's spots tend to be less frequent as higher levels of carotene or of vitamin A are found. Follicular keratosis varies inversely with vitamin A levels, less so with carotene. However, these lesions might be expected to disappear with the higher levels of vitamin A. The poor correlations suggest that the lesions signal prolonged deficiencies, the blood levels more recent adequacy of vitamin or carotene intake.

Nasolabial seborrhea (0 to 34 per cent) and the lip angular lesions (0 to 47 per cent) and scars (3 to 55 per cent), as well as cheilosis (2.3 to 29 per cent) called attention to the frequent occurrence of continued periods when

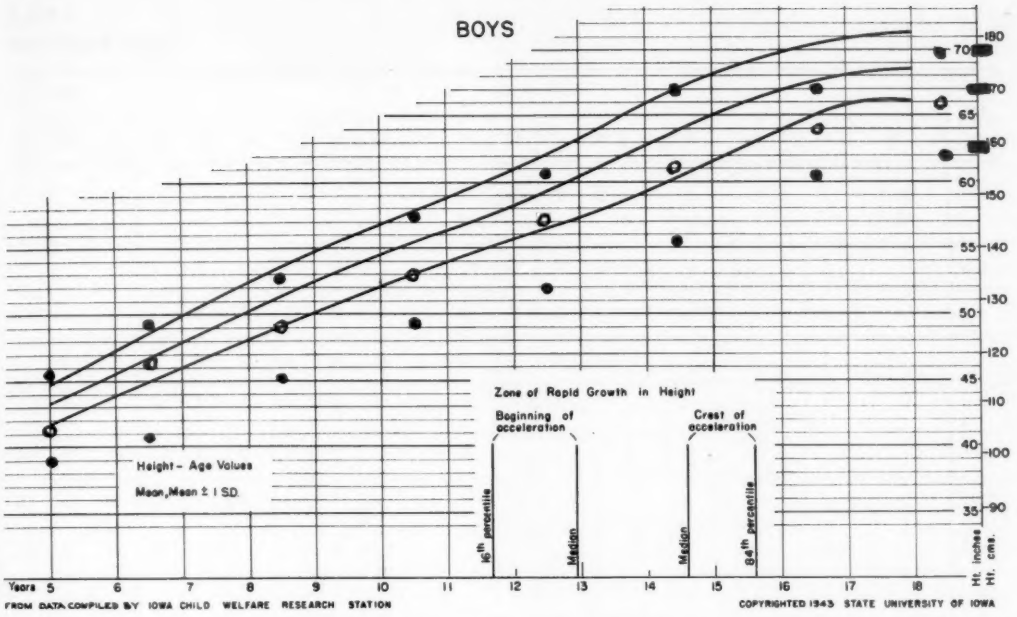

BOYS
Zone of Rapid Growth in Height
Beginning of acceleration
Crest of acceleration
16th percentile
Median
Median
84th percentile
Height – Age Values
Mean, Mean ± 1 SD.
Years 5 6 7 8 9 10 11 12 13 14 15 16 17 18
Ht. inches
Ht. cms.
FROM DATA COMPILED BY IOWA CHILD WELFARE RESEARCH STATION
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FIG. 3. Stature of males in Haiti, compared to Iowa standards. Open circles are means, solid circles are first and ninth deciles. Solid bars at right are adult statures.

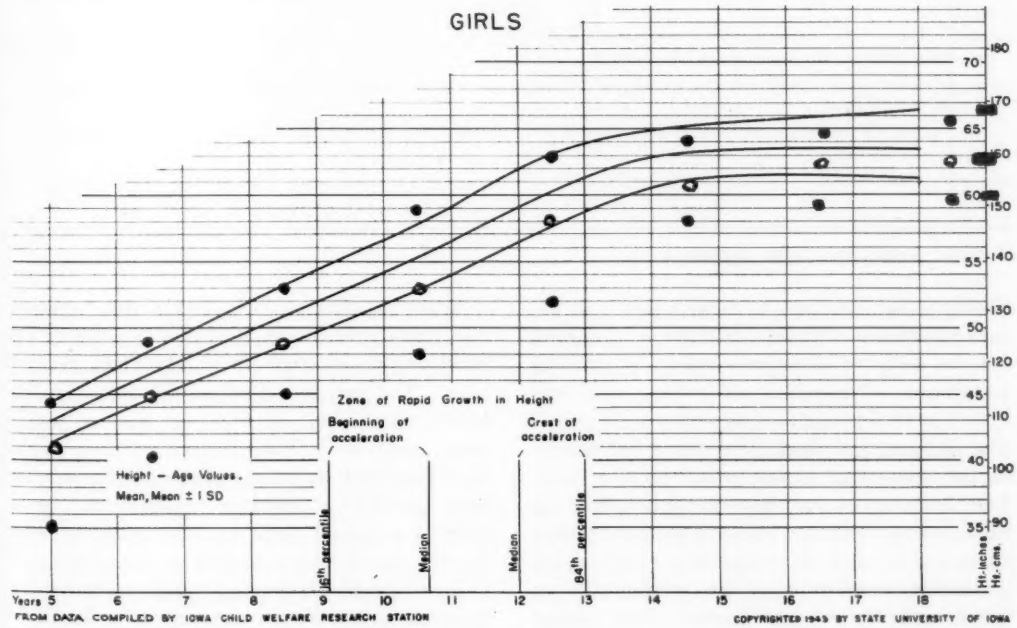
GIRLS
Zone of Rapid Growth in Height
Beginning of acceleration
Crest of acceleration
16th percentile
Median
Median
84th percentile
Height – Age Values.
Mean, Mean ± 1 SD
Years 5 6 7 8 9 10 11 12 13 14 15 16 17 18
Ht. inches
Ht. cms.
FROM DATA COMPILED BY IOWA CHILD WELFARE RESEARCH STATION
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FIG. 4. Stature of females in Haiti, compared to Iowa standards. Open circles are means, solid circles are first and ninth deciles. Solid bars at right are adult statures.

TABLE
Stature Distribution

Age (yr.)	Stature in																		
	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53
5	30-1 33-1	1	1		2	4	3	2	2	5	4	1								
6		1		3	1	2	2	2	6	10	3	2	2	1	1	1	1			
7						1		2	2	6	7	9	9	11	7	4	1	3		
8								1	1	3	1	8	2	8	10	10	7	1	3	
9											3	1	1	7	5	5	4	6	5	4
10										1		1	2	5	6	7	15	11	9	13
11														1	2	4	5	7	15	9
12		1											1	1		3	1	4	5	11
13																			2	
14																				
15																				
16																				
17																				
18																				
19																				
20+																				

NOTE: Values are number of persons.

riboflavin intake must have been low. In the entire population studied 51.5 per cent showed one or more of the three lesions of the lip mentioned. Nasolabial seborrhea was observed in 17.5 per cent of all persons examined. The frequency of these three lesions of the lip in the seborrheic group was 68.7 per cent. The frequency of any one of these four findings varied rather widely. At some stations almost every person showed at least one of the signs. Obviously angular scars are attributable to former open lesions, now healed. But angular moist lesions, cheilosis and seborrhea lead to suspicion of recent deficiency.

No correlation could be established between low urinary riboflavin levels and angular lip lesions or scars, cheilosis or seborrheic dermatitis. The urinary riboflavin levels were at least "acceptable" in 98.5 per cent of specimens analyzed. The dietary studies made simultaneously by other members of the survey team provide a probable explanation. In a country in which little milk is available, and in which most people have little intake of meat or eggs, the riboflavin supply is contributed by mangoes and avocados as much as by all other sources combined. The survey was conducted in June just as mangoes and avocados were

XXIV
of Females by Age

Inches

54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74
1																				
1	1		1																	
11	7	5	3	1		1														
14	13	14	7	4	4	2	1	1												
8	12	10	15	13	9	9	7	3												
1	6	7	9	17	17	16	6	4	7	2										
	1	2	9	6	4	12	16	16	11	9	1	1								
		1	2	6	11	12	11	17	3	10	1	1								
		2	1		2	12	3	12	10	6	3	4	1		1					
		2		2	3	4	6	2	3	4	3									
		1		2	4	10	6	5	7	5	4	2		1	1					
			1			1	3	2	2	5	3				1					
1		4	18	27	54	122	119	132	130	112	97	58	38	12	6	4	2	5		1

becoming seasonally available. It may well be that this was the end of a period of several months of annual riboflavin depletion, marked by lesions at the same time that repletion with riboflavin led to good urinary levels of the vitamin.

Similar comments may be applied to the frequent disorders of lingual papillae, redness of the tip of the tongue (5.6 to 50 per cent) and the visible furrows (1.1 to 55 per cent) in the body of the tongue. Whether these lesions are referable to deficiencies of riboflavin, niacin or other members of the vitamin B group need not be discussed. We made frequent inquiries in dispensaries and hospitals for cases of pellagra, but found only one child who probably was convalescing from acute pellagra. (Confusion of pellagra with kwashiorkor is still a problem in Haiti, as elsewhere.)

Impressive also is the common occurrence of swollen, red gum margins (18.5 to 53 per cent) at all ages and in all locations. Except in children the atrophy (5.6 to 43.5 per cent) and recession (4.2 to 49.7 per cent) of dental papillae also showed chronicity of these lesions. Bleeding or scorbutic gums were observed in 3 per cent of the total group examined. Since an additional 1.5 per cent were edentulous and

TABLE
Physical Findings (Incidence in % of

Physical Findings	Location							
	I		II		III		IV	
	Male (72)	Female (79)	Male (99)	Female (198)	Male (121)	Female (240)	Male (80)	Female (52)
General appearance:								
Fair–good	94.4	96.3	96.0	95.4	92.5	95.0	100.0	94.0
Poor	5.6	3.7	4.0	4.6	7.5	5.0	...	4.0
Cachectic	...	...	...	...	...	...	...	2.0
Thyroid enlarged	1.4	21.5	5.0	33.8	5.8	17.5	16.3	25.0
Parotids enlarged	27.8	6.4	10.0	4.6	13.2	7.5	15.0	9.6
Nasolabial seborrhea	...	6.4	7.1	10.0	23.2	24.2	16:3	9.6
Follicular keratosis	22.2	21.5	17.0	17.2	28.9	15.8	10.0	17.4
Crackled skin	22.2	36.8	63.0	68.2	39.6	48.0	73.5	83.0
Thickened conjunctivas	66.8	63.4	54.0	60.4	33.0	57.0	68.8	81.0
Pingueculas	21.0	24.0	10.0	11.0	21.5	16.5	20.0	30.0
Bitot's spots	1.4	1.3	4.0	6.0	10.7	7.9	6.7	4.0
Lips:								
Angular lesions	7.0	...	9.0	3.0	23.9	18.8	16.3	22.0
Angular scars	3.0	15.0	27.0	29.0	43.0	33.3	3.0	34.8
Cheilosis	2.8	2.5	11.0	11.5	23.9	16.7	8.7	17.4
Filiform atrophy	4.2	1.3	5.0	5.5	9.1	8.7	6.7	16.0
Papillary hypertrophy	23.3	30.4	42.0	38.4	31.4	38.7	20.0	34.8
Tongue:								
Furrows	14.0	20.2	33.0	22.0	38.8	32.5	55.0	38.5
Red tip	5.6	13.0	40.0	31.5	42.0	34.6	50.0	34.8
Glossitis	...	1.3	1.0	1.0	1.6	...	1.25	4.0
Magenta color	1.4	1.3	4.0	1.5	5.0	5.4	7.5	7.8
Red or swollen	27.9	34.2	53.0	36.8	39.7	28.7	32.5	43.0
Atrophy of papillae	5.6	19.0	23.0	24.2	25.0	18.3	35.0	40.5
Gums:								
Recession	4.2	22.8	25.0	22.7	29.8	20.8	42.5	43.0
Bleeding	...	2.5	2.0	1.5	0.8	1.7	...	4.0
Scorbutic type	...	...	...	1.0	...	...	1.25	4.0
Dental caries	41.7	60.8	45.0	61.2	62.0	51.3	67.5	71.0
Bilateral edema	1.4	...	...	2.2	0.8	...	...	5.8

NOTE: Figures in parentheses represent number of persons examined.

far more had many missing incisor teeth, the gravity of gingival disease in the Haitian population is apparent. Attempts to find correlations between frequencies of gum lesions and low levels of blood vitamin C were entirely unrewarding. There were numerous cases of obvious gingival edema, redness, atrophy and even a few with easy bleeding in individuals whose plasma ascorbic acid was above 1.2 mg. per 100 ml. Similarly it was common to find low plasma ascorbic acid values without gingival lesions. "Deficient" and "low" plasma ascorbic acid values were found in only 8.1 per cent of 410 analyses. The great daily as well as seasonal fluctuations in ascorbic acid intake are probably responsible for the failure to find correlations. The diet study showed a per capita intake of ascorbic acid of over 300 mg. daily. This depended upon mangoes for 200 mg. and leaves and vegetables for 50 mg. These sources are highly seasonal and general availability had begun very shortly before the survey occurred. The coincidence of lesions caused by long continued deficiency of ascorbic acid and of blood levels of vitamin C within the accepted normal limits is similar to the

XXV
Sample Examined)

Location													
V		VI		VII		VIII		IX		X		XI	XII
Male (139)	Female (90)	Male (65)	Female (244)	Male (189)	Female (165)	Male (76)	Female (113)	Male (79)	Female (246)	Male (11)	Female (88)	Male (382)	Female (285)
87.0	93.3	94.0	97.0	91.0	95.0	93.5	92.0	95.0	95.0	63.6	87.5	97.4	98.7
13.0	6.7	4.5	3.0	9.0	5.0	6.5	8.0	5.0	4.5	36.4	12.5	2.6	1.3
...	...	1.5	...	...	...	...	...	...	0.5	...	...	...	...
15.2	39.0	9.3	27.0	13.7	28.5	15.8	24.8	6.3	31.7	...	6.7	8.4	17.9
20.8	10.0	13.8	8.2	21.3	15.8	22.4	6.2	14.0	4.5	...	1.1	6.0	6.3
23.0	20.0	23.1	29.6	29.0	28.5	34.2	30.5	19.0	13.0	...	...	5.5	9.1
19.4	16.7	24.8	21.2	24.8	18.2	31.6	17.7	21.5	14.6	...	10.2	18.1	24.2
64.5	60.0	23.1	30.7	47.0	53.3	21.1	38.0	30.4	48.5	63.6	52.3	34.0	52.0
68.5	73.5	69.2	51.2	67.8	65.0	72.3	55.7	82.0	52.5	9.1	14.8	45.8	56.0
15.2	23.4	20.0	10.6	19.5	16.9	36.8	22.0	24.1	27.6	...	...	3.1	0.3
1.5	5.6	7.7	3.7	5.8	6.7	10.5	4.4	13.9	12.6	...	...	0.5	0.3
40.3	37.0	40.0	20.4	47.5	44.8	34.2	21.5	11.8	17.5	...	...	0.5	2.5
41.0	37.8	18.5	34.7	30.1	29.7	35.5	42.5	48.0	44.4	55.0	20.4	14.4	10.2
21.6	28.9	17.0	11.9	19.5	15.7	19.8	15.0	3.8	13.0	9.1	2.3	3.4	8.4
33.0	26.6	26.2	15.1	29.0	20.0	26.3	21.2	17.7	17.1	27.3	3.4	3.9	3.2
21.6	24.5	15.4	25.0	25.4	24.2	13.2	26.6	26.6	32.9	36.6	68.3	28.4	40.3
38.8	45.5	26.2	21.3	29.6	32.2	51.5	39.8	32.9	48.5	...	1.1	8.7	5.3
41.0	36.7	35.4	33.6	34.4	29.7	37.8	31.0	36.7	35.4	27.3	17.1	11.5	24.6
...	1.1	1.6	2.5	2.6	...	1.3	...	3.8	2.0	...	...	0.5	1.0
2.9	3.3	6.2	...	2.6	2.4	1.3	2.6	1.3	0.8	...	...	0.3	0.3
49.5	43.5	18.5	26.6	43.7	44.3	39.5	41.7	35.4	35.4	27.3	42.0	35.4	30.6
32.4	33.3	29.3	13.8	16.4	20.7	43.5	28.3	40.5	22.0	...	...	4.4	2.1
41.7	37.9	37.0	15.3	28.0	31.5	49.7	38.0	46.8	24.2	...	4.6	3.4	4.6
2.2	4.5	...	1.25	3.2	1.8	1.3	4.4	2.5	2.0	...	...	0.3	0.3
3.6	5.5	...	1.6	6.9	0.6	1.3	2.7	25.0	4.5	...	...	...	...
59.0	65.5	43.0	36.0	39.5	43.7	64.5	46.8	55.8	57.0	63.6	22.8	32.5	28.1
2.1	...	1.7	2.1	0.5	1.2	13.1	5.3	2.5	1.6	...	...	...	...

TABLE XXVI
Per Cent Frequency of Physical Findings at Various Plasma Carotene and Vitamin A Levels

Finding	Carotene (%)			Vitamin A (%)		
	<40 Low	40–99 Acceptable	100–100+ High	<20 Low	20–49 Acceptable	50+ High
Thickened conjunctivas	71	85	69	68	68	82
Pingueculas	28	30	29	21	23	44
Bitot's spots	0	15	8.5	11	9	5
Follicular keratosis	0	19	17	32	18	16

observations on lips and riboflavin levels already referred to.

In a well conducted orphanage for girls it was observed that the incidence of red and swollen gums was distinctly higher (42 per cent) than that seen in a public school for girls of comparable ages (30.6 per cent). Direct inquiry at the orphanage revealed that fresh fruit had not been served the girls during a two-month interval because it was not understood that it was nutritionally important.

We do not attempt to interpret the caries data. Well developed teeth with conspicuously infrequent caries were repeatedly noted in children and youths. Whereas chewing sugar cane is common there is little use of candy, carbonated drinks and other confections. Sugar consumption is one-third that in the United States. The diet is, however, high in starchy foods.

Dental fillings were seen in only 2 per cent of our subjects.

Edema was noted in only forty-three persons, of which one-half were in three hospitals. Edema in our cases was not as frequent as might have been expected with a known low protein intake per capita.

The data on enlargement of liver and spleen and on ascites are not tabulated. The circumstances of the examinations made only gross changes detectable. Inquiry by the nurses who registered all subjects elicited a history of malaria in 28 per cent of persons. The direct examination of blood smears obtained from 450 persons was positive in 3.6 per cent. Inquiry about current presence of diarrhea brought affirmative replies in 4.6 per cent of all those examined.

Tenderness of the calf, never extreme, was encountered in only twelve instances. We think our data on the absence of ankle or knee reflexes misleading. On many occasions such absence was observed in adolescent subjects in whom we were certain there was no neurologic disturbance but that apprehension and tension interfered. Also, attempts to determine vibratory sense in the lower extremities were grossly handicapped by language barriers between Haitian subjects and the two American clinicians. In no cases were we even strongly suspicious of a polyneuritis suggesting thiamine deficiency.

TABLE XXVII
Stability of Cholesterol in Blood

Sample and Treatment	Plasma Cholesterol (mg. %)	
	Normocholesterolemic	Hypercholesterolemic
Control, frozen 13 days	67	282
Control, incubated 13 days	66	278
Inoculated, incubated 13 days	67	282

Evidence of former rickets was seen in three subjects. Rickets would not be expected where children with scanty clothing live so largely in the out-of-doors.

Of the several other physical signs observed, such as the quality of hair and depigmentation, the texture of skin or alterations in pigment, inflammatory lesions in eyes, detailed study of teeth, the observations were too confusing or too infrequently positive to merit tabulation and comment. No observations were made on blood pressure or pulse rate.

PLASMA CHOLESTEROL

Portions of blood samples collected in the field were transferred to tubes containing thymol and sodium fluoride. These were sent by air to Dr. David Tennent at the Merck Institute for Therapeutic Research, Rahway, New Jersey, to whom we are indebted for the cholesterol determinations.* In spite of the added preservative and efforts to keep the samples cold en route, most of the plasmas were obviously contaminated upon receipt in the laboratory. In order to determine the effect of the bacterial growth on the level of cholesterol, the following three experiments were conducted.

(I) A combined inoculum from two contaminated plasmas was added to samples of normocholesterolemic and hypercholesterolemic chicken plasma, which were then incubated at 37°C. for thirteen days and analyzed for

* We also wish to thank Mary Zanetti, David Johnson and Gunther Kuron for their technical assistance.

cholesterol with the following results (Table XXVII):

(II) With the thought that more destructive organisms might be found in plasma containing especially low cholesterol levels, three selected samples, selected because of low cholesterol values (83, 65, 68 mg./100 ml.), were used to inoculate portions of normocholesterolemic dog plasma. These were incubated at room temperature for five days and analyzed for cholesterol with the following results (Table XXVIII):

TABLE XXVIII
Stability of Cholesterol in Inoculated Plasma

Sample and Treatment	Plasma Cholesterol (mg. %)
Control, frozen 5 days	93
Control, incubated 5 days	97
Control, incubated with NaF and thymol, 5 days	96
Inoculated with Sample No. I	83
Inoculated with Sample No. II	95
Inoculated with Sample No. III	84

(III) Plasmas no. I and no. III were then plated, and two organisms were isolated in pure culture from sample no. I, and three organisms from sample no. III. These were used to inoculate sterile, hypercholesterolemic chicken serum, which was incubated at room temperature for four days and analyzed for cholesterol with the following results (Table XXIX):

The only significant decrease was observed with organism c from sample no. III (Table XXIX) in which the decrease was 18 per cent. However, this occurred with a pure culture from the original sample. The decrease observed on five days' incubation with sample no. III (Table XXVIII) showed a decrease of only about 12 per cent. Therefore, it was concluded that while contamination could lead to error and should be avoided, it was unlikely that its effect here was great enough to influence the interpretation of the results.

TABLE XXIX
Stability of Chicken Serum Cholesterol

Sample and Treatment	Cholesterol (mg./100 ml.)	% Change
Control, frozen 4 days	396	...
Control, incubated 4 days	395	...
Incubated, Sample No. I organism a	399	+0.75
Incubated, Sample No. I organism b	419	+5.5
Incubated, Sample No. III organism a	387	−2.3
Incubated, Sample No. III organism b	412	+4
Incubated, Sample No. III organism c	325	−18

The distribution of the plasma cholesterol values for males and females is given in Table XXX. It is of interest to note the relatively low values. The highest value in the entire sample was 218 mg./100 ml. In only 5 per cent of the males and 13 per cent of the females did values exceed 180 mg./100 ml.

TABLE XXX
Per Cent Distribution of Plasma Cholesterol Levels

Subjects	Cholesterol Levels (mg./100 ml.)				
	50–99	100–139	140–179	180–199	180–219
194 females	10	47	30	..	13
129 males	13	50	32	5	..

NOTE: Numbers are the per cent of sample in each group.

The serum cholesterol values are presented in greater detail in Table XXXI. The data fail to show any significant correlation with the occurrence of goiter, age and sex, or per cent of standard body weight. There is possibly a tendency for association between low serum cholesterol and low serum protein and serum albumin, similarly between higher levels of serum protein, serum albumin, and serum cholesterol.

SUMMARY

This survey of Haiti included appraisal of agricultural resources, food habits and vital statistics, as well as clinical examinations of more than 3,000 persons in a number of villages and cities. In addition, biochemical determinations were carried out on specimens of blood and urine from about 15 per cent of those undergoing physical examinations. Concur-

TABLE

Distribution of Serum Cholesterol Levels

Cholesterol Levels (mg./100 ml.)	No. Persons	No. with Goiter	% in Each Age Group				% of Standard		
			5–19	20–39	40–49	50+	<70	70–79	80–89
									194
50–99	19	2	37	53	5	5	5	11	21
100–119	40	10	28	50	18	5	3	23	35
120–139	52	12	33	52	10	6	4	12	33
140–159	31	9	42	45	10	3	..	10	29
160–179	27	8	11	52	22	15	..	19	22
180–199	13	1	54	31	8	8	..	23	31
200–219	12	5	58	25	17	..	..	17	17
									129
50–99	17	2	41	24	18	18	..	18	41
100–119	29	2	41	38	10	10	3	17	38
120–139	35	4	43	46	9	3	..	23	37
140–159	21	0	29	33	14	24	5	19	29
160–179	21	2	43	38	10	10	5	19	62
180–199	6	0	17	50	0	33	17	17	33

* In twenty-three instances of 323 cholesterol determinations, the serum protein or serum albumin determina-

rent with this study was a clinical appraisal of nutrition in infants and children up to five years of age, with similar geographic distribution, by Dr. and Mrs. D. B. Jelliffe.

A careful evaluation of all the information obtained indicates that the Haitian peasant suffers from multiple nutritional deficiencies. The most important of these appear to be insufficient calories and protein, as evidenced by underweight, poor muscular development, short stature and a high total serum protein with a relatively low serum albumin. Kwashiorkor, in all degrees of severity, was present in young children. There were some clinical suggestions of vitamin A deficiency which were further borne out by relatively low serum vitamin A levels, although serum carotene levels were high. A few cases of scorbutic gums and some gingival disease were found. A number of small goiters were seen, indicating a need for more iodine. There was considerable clinical evidence of widespread riboflavin deficiency but there was no correlation of these findings with low urinary riboflavin values. Serum cholesterol levels were low in keeping with the low fat, low protein diets. Moderate anemia was frequently noted. The data do not provide a basis for determining whether the deficiency was of iron, protein, or vitamins. Probably all are involved.

This survey showed that the Interdepartmental Committee technics are adaptable to a civilian population with the cooperation of the Health Department. The number of professional people required for this type of survey makes it expensive and difficult to organize. However, it is within the capabilities of a team of civilians with non-governmental support. The technics probably can be modified further in order to reduce the expense and still yield the necessary data. These technics, in our opinion, represent the best available method for appraising the nutritional problems of a country and furnishing the necessary collateral data on which a broad practical program for nutritional improvement can be based.

RECOMMENDATIONS

The principal needs in the Haitian diet are for more foods with better protein content,

XXXI
by Sex, Age, Weight and Serum Protein

Body Weight				Total Serum Protein*				Serum Albumin*			
90–99	100–109	110–119	120–149	5.0–5.8	5.9–6.9	7.0–8.0	>8.0	1.0–2.9	3.0–3.9	4.0–4.9	5.0–6.9
Females											
58	5	..	..	11	37	47	5	37	32	16	..
20	8	8	5	5	30	43	20	13	53	33	..
31	12	6	4	..	27	56	17	4	50	33	8
48	13	..	..	..	29	52	19	..	48	35	10
48	7	4	..	..	22	30	44	4	41	33	11
23	23	..	..	..	15	62	23	..	69	31	..
33	8	17	8	..	8	8	67	..	25	50	8
Males											
29	12	..	..	6	47	18	29	6	47	35	6
28	10	..	..	..	28	55	14	3	48	41	7
29	11	..	..	3	14	43	40	3	29	51	14
38	10	..	..	5	14	43	38	5	38	33	19
14	..	..	..	10	10	48	33	..	24	57	14
33	..	..	..	..	17	50	33	17	33	50	..

tions are not available. Therefore, in many cases, the figures for per cent as given total less than 100.

more fat or oil, and foods with improved riboflavin and vitamin A values. Increased intake of iron and iodine are important. It is our opinion that these needs can be met within Haiti's own resources. Seasonally recurring deficiencies of ascorbic acid and riboflavin are probable. A number of specific recommendations are made which may be, for convenience, classified as immediate measures and long-range plans.

Immediate Measures

1. Creation of a nutrition division in the Department of Public Health to work cooperatively with the Departments of Agriculture and Education. Through this nutrition division the following steps should be taken:

(a) Increase the distribution of UNICEF dried skim milk and vitamin A capsules through hospitals and medical dispensaries, especially to pregnant and lactating women, and to infants and children.

(b) Include more rural schools in the UNICEF dried skim milk and vitamin A distribution plan.

(c) Make dried skim milk available for the treatment of kwashiorkor and for all sick children in hospitals.

2. Iodate should be added to all salt.

3. Add riboflavin, niacin, thiamine and iron to all white wheat flour in accordance with the enrichment standards observed in the United States. This is inexpensive and materials and methods are readily available as a result of long experience in the United States.

4. Encourage the use of parboiled rice wherever rice is a staple of the diet.

5. Encourage the greater use of avocados.

6. Encourage the production of more chickens and eggs for home consumption.

7. Increase the availability and use of fish.

8. Encourage greater use of beans, peas, cashew nuts and peanuts as means for improving the intake of proteins.

Long-Range Plans

1. One of the most fundamental causes of malnutrition in Haiti is the small amount of food that the peasant is able to produce for his own use on the land available to him and by

using the inefficient agricultural methods. Ways must be found to increase the total amount of food available to the Haitian peasant family through improved agricultural practices and more efficient land use. Toward this end it is imperative that the program of soil conservation be strengthened. Furthermore, the Department of Agriculture, through the Extension Service, should play a vital role in bringing about improved crop yields by encouraging the use of fertilizers and insecticides, by introducing new crops and more productive strains of established crops. In cooperation with the Department of Education a program for the dissemination of information on the improvement of agricultural and dietary practices should be established.

2. It is difficult to teach new agricultural practices to the illiterate, even with the best efforts of the Extension Service. The program to combat illiteracy should be vigorously extended and should include the teaching of nutrition in its context. Public educational programs by means of radio, pictures, posters, etc. should be developed, which stress the health benefits of better nutrition.

3. Nutrition education should be included in the curricula of all rural and primary schools.

4. A vigorous program of increased livestock production should be undertaken.

5. The development of the Haitian fish and sea food industry should be supported.

6. The conservation and preservation for out-of-season use of vegetables and the abundant fruits of Haiti by canning, production of juice concentrates, jams and jellies, using the readily available sugar, should be encouraged.

7. Irrigation systems should be developed further and coordinated with those of the Artibonite Valley authority and the Department of Agriculture.

8. Population control studies should be inaugurated without delay. The rapid growth of the Haitian population (2 per cent annually) imposes an ever-increasing strain on the food resources. Studies should be started toward devising an effective and practical means for controlling the rate of population growth.

It is fully recognized that many of these proposals are general in nature and will require many years and considerable resources to carry out. However, the team was greatly impressed with the vigor, earnestness, independence and desire for improvement in the Haitian people.

Much can be accomplished, as recommended under Immediate Measures, from a small beginning with modest resources.

ACKNOWLEDGMENT

This study would have been impossible without the generous cooperation and assistance of many organizations and individuals. Dr. Francois Duvalier, President of Haiti, gave the wholehearted support of the government of Haiti and took a personal interest in the project. Dr. Auguste Denizé, the Minister of Health, and Dr. Roger Rousseau, the Director General of Health, gave the enthusiastic support of the Health Department, provided personnel and made the facilities of hospitals, clinics and dispensaries available for use in the study. The examinations would have been impossible without these resources which served as centers for making the clinical observations. Dr. Carlos Boulos, the Assistant Director of Health, was personally interested in nutrition, having already made some studies. He made many of the detailed arrangements and visited the team in the field. Dr. Joseph Lacombe, Director of the National Laboratory of Public Hygiene, provided three air-conditioned laboratory rooms with all facilities, which contributed greatly to the success of the laboratory work. Mr. Harry W. Yoe of the USOM, Mr. A. E. Williamson and Dr. Sarah H. Bowditch of the Service Cooperatif Inter-Américan de la Santé Publique (SCISP), gave invaluable assistance with transportation, personnel and administrative problems. Personnel of the Department of Agriculture at Damiens contributed helpful information on agricultural practices. Dr. W. L. Mellon made available all the facilities of the Albert Schweitzer Hospital at Deschapelles, which enabled the team to make an adequate study of the rural population of the Artibonite valley. Mr. Albert Lebel of the U.N. Bureau of Technical Assistance, gave every possible help to further the success of the study in contributing transportation and personnel, and in giving generously of his own time. The Nutrition Division of FAO permitted their nutrition consultant in Haiti, Miss Lucienne Gemeau, to spend a week with the team assisting in the collection of food consumption data, and the United Nations Children's Fund gave the assistance of Dr. C. E. French for two weeks in the field, also collecting information on food consumption.

The entire study was organized and supported as a direct project of the Williams-Waterman Fund for the Combat of Dietary Diseases of the Research Corporation, because of the cooperative nature of the effort and the numerous widely separated institutions, organizations and individuals involved.

The Effect of an Intravenous Fat Infusion on Blood Coagulation

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THE EFFECT of fat ingestion on blood coagulation in man has been the subject of rather intensive investigation, but the results have been conflicting and the effect of lipemia on coagulability of the blood *in vivo* has not been clearly defined. A decrease in the whole blood coagulation time and the Russell viper venom or "Stypven" time are most frequently observed as the result of lipemia, but the significance of these changes as an index of coagulability of the blood *in vivo* is open to question.[1] The importance of determining the effect of lipemia on blood coagulation is obvious, since increased coagulability of the blood could play an important role in initiating intravascular thromboses and is subject to control by restriction of dietary fat. The current status of the relationship of fat ingestion to blood coagulation has been recently reviewed.[2,3]

When a fat emulsion suitable for intravenous use became available, it seemed worthwhile to determine the effect of this preparation on blood coagulation. Previous studies on the effect of lipemia on blood coagulation have been performed in subjects with a normal coagulation mechanism. Since the effect of lipemia is assumed to be an increase in the coagulability of the blood, it was considered worthwhile to evaluate the effect of lipemia in subjects with coagulation disorders. The results of studies of blood coagulation, following the infusion of an intravenous fat preparation (Lipomul®)‡ in normal subjects and in subjects with coagulation disorders, constitutes the present report.

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‡ The Upjohn Company, Kalamazoo, Michigan.

MATERIAL AND METHODS

The subjects comprising this study were hospitalized on the wards of the Louisville General Hospital. The subjects utilized as normal controls had no evidence of a coagulation defect and were not acutely ill at the time of study.

The effect of the infusion of Lipomul was studied in three types of coagulation defects: hypoprothrombinemia, hemophilia and thrombocytopenia. The subjects with hypoprothrombinemia were selected on the basis of a prolonged one-stage prothrombin time. This group consisted primarily of subjects with liver disease.

Lipomul, the intravenous fat preparation utilized in these studies, has the following composition per 100 ml.: Cotton seed oil, 15 gm.; phosphotides (purified soya lecithin), 1.2 gm.; pluronic F-68, a synthetic coemulsifier, 0.3 gm.; and dextrose, 4.0 gm.[4] Lipomul, 500 cc., was given intravenously to the subjects in a fasting state, and the period of infusion ranged for from two to three hours.

The following coagulation studies were performed before and within thirty minutes after the infusion. The methods utilized are as described by Miale and the normal value for these procedures in our laboratory are indicated in parentheses.[5] The whole blood coagulation time by the Lee and White method (ten to fifteen minutes) and in siliconized glassware (twenty to forty minutes), the one-stage prothrombin time utilizing human brain as a source of thromboplastin (twelve to fourteen seconds), prothrombin consumption (more than twenty seconds), the Russell viper venom

TABLE I

Blood Coagulation Studies Before and After Infusion of Lipomul in Normal Subjects

Case No.	Coagulation Time				Prothrombin Time (12–14 sec.)		Prothrombin Consumption (>20 sec.)		Russell Viper Venom Time (14–16 sec.)		Thromboplastin Generation Test (Maximal Activity) (min.)	
	Lee and White (10–15 min.)		Silicone (20–40 min.)									
	Before	After	Before	After	Before	After	Before	After	Before	After	Before	After
1	12	10	25	38	13	13	31	20	16	8	3	4
2	10	15	20	33	14	14	24	25	16	9	3	5
3	12	6	22	8	12	12	20	22	15	5	2	2
4	15	15	—	—	12	11	48	23	23*	17	—	—
5	13	17	24	22	14	14	22	22	27*	16	4	4
6	10	11	20	60	14	14	—	—	16	5	3	3
7	15	12	25	19	12	12	—	—	14	7	—	—
8	13	12	39	20	14	14	40	29	22	8	4	3
9	15	13	70	65	13	14	28	27	13	7	2	2
10	15	13	26	13	11	12	—	—	16	5	4	3
11	15	14	19	16	—	—	—	—	—	—	4	3
12	12	13	35	31	14	13	—	—	22*	8	4	3
13	10	15	—	—	11	12	—	—	14	8	6	5

* Venom time performed on platelet poor plasma.

(Stypven) time (fourteen to sixteen seconds) and the thromboplastin generation test. The results of the thromboplastin generation test are expressed as the time of maximal activity of the incubation mixture. In normal subjects, maximal activity generally occurs within the first three minutes of incubation. In several instances the venom time was performed on platelet poor plasma which resulted in a prolongation above the normal range for platelet rich plasma. These exceptions are indicated in the tables.

RESULTS

The results of the coagulation studies performed before and after the infusion of Lipomul in ten normal subjects are shown in Table I. The most consistent and significant change observed was a decrease in the Russell viper venom time. The whole blood coagulation time showed no consistent or significant change. The prothrombin time, prothrombin consumption and thromboplastin generation were not altered by the infusion.

The results of the coagulation studies in the patients with hypoprothrombinemia are shown in Table II. As in the normal subjects, the most consistent change observed was a decrease in the Russell viper venom time. A decrease in the whole blood coagulation time following the infusion was noted in some instances, but was not consistent or significant. The abnormal one-stage prothrombin time was not significantly changed.

The results of the coagulation studies performed in the subjects with hemophilia and thrombocytopenia are shown in Table III. In the subjects with hemophilia, coagulation times were not performed in siliconized glassware because they were greatly prolonged both before and after the infusion, and accurate determination was difficult. The thromboplastin generation test was not performed in two of the subjects with thrombocytopenia because of the low platelet yield of the plasma. The results of the studies in the subjects with hemophilia and thrombocytopenia were essentially similar to those in the normal control subjects and the group with hypoprothrombinemia; a decrease in the Russell viper venom time. The abnormal prothrombin consumption and thromboplastin generation were

TABLE II

Blood Coagulation Studies Before and After Infusion of Lipomul in Subjects with Hypoprothrombinemia

Case No.	Coagulation Time				Prothrombin Time (12–14 sec.)		Prothrombin Consumption (>20 sec.)		Russell Viper Venom Time (14–16 sec.)		Thromboplastin Generation Test (Maximal Activity) (min.)	
	Lee and White (10–15 min.)		Silicone (20–40 min.)									
	Before	After	Before	After	Before	After	Before	After	Before	After	Before	After
1	11	12	60	46	18	20	—	—	25	8	—	—
2	17	14	62	40	16	15	—	—	16	12	5	4
3	16	13	66	47	18	17	48	23	20	10	4	6
4	20	18	80	45	23	22	25	32	30	15	6	5
5	11	8	27	30	15	16	—	—	20	6	—	—
6	15	17	—	—	19	20	—	—	21	10	5	5
7	13	13	29	23	15	16	37	34	18	7	—	—
8	14	14	59	58	15	15	37	22	16	7	6	5
9	14	16	—	—	16	14	—	—	10	9	—	—
10	14	19	29	29	16	17	—	—	25	11	5	6
11	11	12	—	—	21	21	33	22	37	8	6	6
12	15	15	75	75	21	20	—	—	18	12	6	3
13*	18	17	—	—	30	32	65	56	28	10	—	—
14†	14	13	26	13	18	14	—	—	17	12	—	—

* Dicumarol induced hypoprothrombinemia.
† Congenital Factor VII deficiency.

TABLE III

Blood Coagulation Studies Before and After Infusion of Lipomul in Subjects with Thrombocytopenia and Hemophilia

Case No.	Coagulation Time				Prothrombin Time (12–14 sec.)		Prothrombin Consumption (>20 sec.)		Russell Viper Venom Time (14–16 sec.)		Thromboplastin Generation Test (Maximal Activity) (min.)	
	Lee and White (10–15 min.)		Silicone (20–40 min.)									
	Before	After	Before	After	Before	After	Before	After	Before	After	Before	After
Subjects with Thrombocytopenia												
1	11	9	70	42	13	13	13	12	—	—	—	—
2	11	11	23	30	12	13	13	15	21	9	—	—
3	13	12	16	14	14	15	19	18	18	6	2	2
4	15	15	—	—	12	12	14	14	20	7	2	2
5	14	19	29	29	16	17	21	20	25	11	5	5
Subjects with Hemophilia												
1	31	24	—	—	13	13	10	12	10	8	6	6
2	90	105	—	—	14	14	12	12	*24	8	2	2
3	120+	120+	—	—	15	14	10	12	13	10	4	4
4	120+	120+	—	—	13	13	13	13	*21	12	6	6

* Venom time performed on platelet poor plasma.

neither corrected nor made worse by the infusion of Lipomul. Platelet counts were performed before and following the infusion of Lipomul in the subjects with thrombocytopenia but no significant change was noted.

COMMENTS

The only significant and consistent change observed following the infusion of Lipomul was a decrease in the Russell viper venom time. This change was observed in both the normal subjects and those with coagulation defects and is in essential agreement with the findings following the ingestion of fat.[2,3] A decrease in the Russell viper venom time as a result of lipemia has been considered to represent hypercoagulability of the blood.

There are several ways in which lipemia could result in hypercoagulability of the blood. Increased coagulability of the blood could occur as a result of lipemia if lipids possessed inherent properties capable of initiating coagulation, e.g., thromboplastic activity. Studies with platelet derivatives have demonstrated that certain phospholipids possess thromboplastic activity and produce normal thromboplastin generation when substituted for platelets in the thromboplastin generation test. The platelet phospholipid associated with potent thromboplastic properties is phosphitidylserine.[6] The results of the studies described herein do not indicate that the phospholipid of Lipomul supplemented intrinsic thromboplastin generation since the abnormal prothrombin consumption and thromboplastin generation test observed in the subjects with thrombocytopenia and hemophilia were not corrected.

Lipemia could enhance coagulability of the blood by potentiating or accelerating the activity of the plasma factors necessary for normal blood coagulation. The failure of the induced lipemia to decrease the prothrombin time in hypoprothrombinemia, or to enhance intrinsic thromboplastin generation in hemophilia and thrombocytopenia, is not consistent with this hypothesis. It is abundantly clear, however, that lipemia can potentiate the activity of Russell viper venom, but the mechanism by which this potentiation occurs is obscure. Russell viper venom is a partial thromboplastin which has an action like certain antecedents of thromboplastin resembling a mixture of Christmas factor, antihemophilic globulin and factor VII.[7] Viper venom is a foreign substance in relation to human blood coagulation and potentiation of its activity by lipemia is of doubtful significance as an index of coagulability of the blood *in vivo*. Lipemia does not potentiate intrinsic thromboplastin generation as reflected by the thromboplastin generation test, but might potentiate the activity of thromboplastins derived from tissues similar to the potentiation of Russell viper venom. This potential mechanism of lipemia-induced hypercoagulability has not been adequately studied. Studies are in progress in our laboratory to determine whether or not lipemia potentiates the thromboplastic activity of material derived from the intima of normal and arteriosclerotic blood vessels.

Lipemia could also increase and enhance coagulability of the blood by inhibiting the effect of fibrinolysin. Greig has reported inhibition of fibrinolytic activity *in vitro* by lipemia following the ingestion of fat and the magnitude of the inhibition varied with the degree of lipemia.[8] This important mechanism by which lipemia might enhance coagulability of the blood requires further study.

The available evidence does not provide an adequate basis for attributing enhanced coagulability of the blood to lipemia *per se* and of the mechanisms outlined herein, the potentiation of the coagulant activity of Russell viper venom is the most consistent finding. The demonstration of an intermediate product in intrinsic thromboplastin generation or a tissue thromboplastin with properties similar to Russell viper venom would enhance the validity of the venom time as a measure of coagulability of the blood *in vivo*. The present technics available for the study of blood coagulation *in vitro* are inadequate to evaluate enhanced coagulability of the blood *in vivo*. The development of more adequate technics for determining the coagulability of blood *in vivo* is necessary, since a recent report of increased coagulability of the blood in patients with ischemic heart disease and its correction by restriction of dietary fat implies that dietary fat may have a role in the genesis

of thrombosis other than in producing arteriosclerosis.[9,10]

A febrile reaction associated with thrombocytopenia has been observed in some patients who have received consecutive infusions of 10 or more units of Lipomul. We did not observe any untoward reaction or bleeding tendencies following the infusion of a single unit of Lipomul in either the normal subjects or those with coagulation disorders. There was no evidence from the coagulation studies described that abnormalities in coagulation were made worse by the infusion. Daily infusions of Lipomul were given for ten days to one subject with hemophilia and to one subject with hypoprothrombinemia without any clinical evidence of bleeding, thrombocytopenia or alteration in blood coagulation.

SUMMARY

The results of blood coagulation studies following intravenous fat infusion in normal subjects and patients with coagulation disorders are reported. The only consistent change noted was a decrease in the Russell viper venom time. The Russell viper venom time is considered to be a poor indicator of coagulability of the blood *in vivo*. It is suggested that there is no conclusive evidence that lipemia *per se* results in hypercoagulability of the blood.

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Serum Cholesterol Levels of North American Women Living in Guatemala City

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HUMAN serum cholesterol levels throughout the world have received great attention during recent years, because of their association with the incidence of ischemic heart disease. The populations of most technically underdeveloped countries are relatively free of coronary artery disease and tend to have lower serum cholesterol values. In Central America persons in rural and urban lower socioeconomic groups have been found to have much lower serum cholesterol levels than those in an upper socioeconomic category.[1–3] Postmortem studies indicate that the lower socioeconomic groups in Central America are relatively free of advanced lesions of atherosclerosis as compared with the United States white populations in New Orleans[4,5] and Los Angeles.[6]

Environmental factors, such as economic, social and religious differences, play an important role in determining both the characteristic dietary pattern and the physical activity of populations. These in turn appear to be largely responsible for the variations in mean serum cholesterol levels among different population groups. In particular, quantity and quality of dietary fats, and the caloric intake have been shown to influence serum cholesterol levels among populations. This has already been extensively reviewed.[7–9] Immigrants who adopt the food pattern of the recipient country rapidly acquire its average serum cholesterol levels.[10] It is also of interest to determine these levels in persons who change their environment without appreciably changing their food habits. The present report deals with a group of North American women who, as wives or relatives of North American men working in Guatemala City, have lived for at least two years in this region.

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MATERIALS AND METHODS

Forty-two apparently healthy non-pregnant women volunteered for the present study. Their age range was from twenty to sixty years and special care was taken to obtain an even distribution among age groups. Most were married.

Age, weight, height and blood pressure were recorded and finger tip blood samples obtained for the determination of serum cholesterol levels. Relative weights as percentage of standard weights for height were calculated using the weight-height tables given by Keys.[11] Serum cholesterol was determined in 0.05 ml. samples by the method of Abell et al.[12]

A seven-day dietary questionnaire was filled out by two or three women selected at random from each age group. They recorded their own total daily food and beverage intake according to our detailed instructions. It is believed that full cooperation was given in recording foods and food intake accurately. Standard food composition tables[13–15] were used to calculate the nutritional value of the diets. For the estimation of the dietary fatty acid content, the table of Hardinge and Crooks[16] was used. Ninety-six per cent of the total fat intake was accounted for in these calculations.

TABLE I

Age, Height, Weight and Blood Pressure of North American Women Residing in Guatemala City

	Age Groups in Years			
	20 to 29	30 to 39	40 to 49	50 to 59
Number studied	7	12	13	10
Mean age (yr.)	26	36	46	53
Height (cm.)				
Mean	167.6	165.1	162.6	162.6
Standard deviation	5.0	5.4	5.3	5.0
Weight (kg.)				
Mean	60.9	61.8	60.0	61.8
Standard deviation	12.4	11.2	8.9	8.8
Relative weight (%)	97.0	98.8	92.7	94.0
Blood pressure (mm. Hg)				
Systolic				
Mean	118	119	130	126
Standard deviation	12	9	10	13
Diastolic				
Mean	83	79	81	81
Standard deviation	12	8	6	6

RESULTS

The age, height, weight, relative weight and systolic and diastolic blood pressures are presented in Table I. The average body weights were constant in all groups. They tended to be lower than the reference standards, although the large standard deviations reflected the great individual variation. The average height was similar in all groups, although the women under forty years of age were slightly taller than those over forty years of age. Systolic blood pressures were slightly lower in the younger groups but diastolic blood pressures did not vary appreciably. None had systolic and diastolic blood pressures above 140/90 mm. Hg.

In Table II the cholesterol levels obtained in the present study are compared with previous values for Guatemalan women residing in Guatemala and American women residing in the United States.[1] The mean serum cholesterol levels were lower than those of either the urban upper income women in Guatemala or the American women in the United States. Serum cholesterol levels increased significantly with age and the values for the older groups, forty to forty-nine and fifty to fifty-nine years, did not differ from the other two comparable socioeconomic groups of the same age. The proportion of calories derived from fat in the groups compared is also shown in Table II.

TABLE II

Comparison of Serum Cholesterol Levels of Different Guatemalan Population Groups with Those of North American Women Residing in Guatemala City

	Age Groups in Years				Proportion of Calories Derived from Dietary Fat (%)
	20 to 29	30 to 39	40 to 49	50 to 59	
North American women residing in Guatemala:					
Number studied	7	12	13	10	
Mean cholesterol*	164	178	217	238	39
Standard deviation	19	28	42	27	
North American women living in United States:[1]					
Number studied	43	51	108	48	
Mean cholesterol	189	203	219	247	40
Standard deviation	+69−51	+47−39	+48−29	+61−48	
Urban Guatemalan women (upper income):[1]					
Number studied	20	24	16	10	
Mean cholesterol	172	200	208	222	36
Standard deviation	+52−39	+45−36	+47−38	+41−35	
Rural Guatemalan women (lower income):[1]					
Number studied	22	15	11	9	
Mean cholesterol	147	156	172	138	8
Standard deviation	+34−28	+33−28	+35−29	+67−46	

* Serum cholesterol expressed in mg. per 100 ml.

It was almost identical in the Guatemalan urban women, the American women in Guatemala and the American women in the United States. For the rural Guatemalan women who represent a lower socioeconomic group, fat consumption and serum cholesterol levels were much lower.

The average daily dietary intake of the subsample studied is presented in Table III. The

TABLE III

Daily Dietary Intake of North American Women Residing in Guatemala City

Dietary Intake	Average Intake (gm.)	Per cent of Total Calories	Dietary Intake	Average Intake (mg.)
Calories*	2068	...	Minerals:	
Total protein	74.1	14.3	Calcium	956
Animal protein	48.9	9.4	Phosphorus	1147
Carbohydrates	221.8	42.9	Iron	19.8
Total fat	89.3	38.9	Vitamins:	
Animal fat	47.5	20.6	Vitamin A†	5933
Fatty acids:			Thiamine	1.1
Saturated	32.7	14.2	Riboflavin	1.5
Unsaturated	49.2	21.4	Niacin	15.0
Oleic	38.0	16.5	Vitamin C	169
Essential	11.2	4.9		

* Including 100 calories derived from alcohol.
† International units.

requirements for calories, proteins, calcium, iron and vitamins were adequately fulfilled. Protein furnished 14.3, fat 38.9 and carbohydrates 42.9 per cent of total caloric intake. Of the total calories, 4.8 per cent were furnished by alcohol. Saturated fatty acids furnished 14.2 and unsaturated fatty acids, 21.4 per cent of total calories. Essential fatty acids constituted 22.8 per cent, and oleic acid 77.2 per cent of total unsaturated fatty acids.

COMMENTS

In both rural and urban low income Guatemalan population groups, cholesterol levels have been found to be lower than those of upper socioeconomic groups in Guatemala and the United States. Postmortem studies showed a low prevalence of cardiovascular atherosclerotic complications. Lower income population groups in Guatemala have much less aortic[4,5,18] and probably less coronary[17] atherosclerosis than reported for the United States and European countries. Due to the difficulties in obtaining postmortem material representing upper income groups in Guatemala, there is no proof that they have a degree of atherosclerosis similar to the populations of technically more developed countries. There is, however, strong clinical evidence that they have far more deaths due to atherosclerotic complications than their lower income compatriots.

Dietary surveys have also shown marked differences in the amount and type of fat consumed among different socioeconomic groups in Guatemala. The rural highland Indian consumes about 8 per cent of his total calories as fat, almost entirely derived from corn. The upper income urban population consumes about 36 per cent of its total calories as fat, a large proportion of which is of animal origin; the types of fat are very similar to those consumed in the United States.

Systematically conducted dietary surveys in the United States agree fairly well in their estimates of calories derived from fat consumption.[19,20] In the present study, the fat content and the general pattern of the diet of the American women living in Guatemala for at least two years did not differ appreciably from studies in the United States.[19] Protein furnished 14.3, carbohydrates 42.9, and fat 38.9 per cent of total caloric intake as compared with the 16.2, 40.9 and 42.2 per cent, respectively, reported by Friedman and Rosenman.[19] If alcohol ingestion is not taken into consideration, the percentages become 15.0, 45.1 and 40.8, respectively, and resemble even more closely the values reported for the United States. The distribution of fatty acids in the total dietary fat of the American women studied, closely resembled that of similar persons living in the United States.[21]

It is apparent from this study that with the exception of the younger groups, the serum cholesterol levels of American women living in Guatemala City are in the same order of magnitude as those reported for similar women residing in the United States.[1,2,7,20] The lower serum cholesterol values found in the

younger groups, twenty to twenty-nine and thirty to thirty-nine years of age, may be due to errors in random sampling or to greater physical activity associated with a favorable climate and to careful control of body weight.

From the food consumption data given, it is evident that the American women in Guatemala had not changed their food pattern appreciably from that formerly consumed in their native country. Since serum cholesterol levels also appear to be unchanged, there can be no other factors in their environment or way of life in Guatemala City which influence serum cholesterol levels significantly.

SUMMARY

Serum cholesterol levels of forty-two apparently healthy non-pregnant North American women who have lived in Guatemala City for at least two years were determined. The groups were twenty to twenty-nine, thirty to thirty-nine, forty to forty-nine and fifty to fifty-nine years of age. Dietary histories were obtained from two to three subjects at random in each age group and the nutritive value of their diet was calculated. Fat consumption and dietary habits were found unchanged from the habits in their country of origin. The cholesterol levels were found to be slightly lower than the United States standards for women under forty years of age and to be similar for older groups.

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Cholesterol Levels of Maternal and Fetal Blood at Parturition in Upper and Lower Income Groups in Guatemala City

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POPULATION DIFFERENCES in serum cholesterol levels have received attention because of the association of high values with the prevalence of atherosclerosis in certain areas. The Guatemalan and Costa Rican lower income populations have been found to be relatively free of the complications of atherosclerosis[1,2] and to have lower serum cholesterol values than persons in either the upper income groups in Guatemala[3,4] or the general population groups in the United States and western Europe.[5] Although similar serum cholesterol differences have been observed among school children in Guatemala[6] no comparable information is available for children under school age in this region. In the present study the total serum cholesterol levels of two widely different socioeconomic groups of newborn infants and their mothers at the time of delivery in Guatemala City were determined.

MATERIAL AND METHODS

Twenty-one mothers who, as wives of business and professional men and patients of private physicians, represented an "upper socioeconomic group," and 23 women delivered in a general hospital for charity patients in Guatemala City who belonged to a "lower socioeconomic group," were studied. Blood samples were obtained within 5 minutes after delivery by venipuncture of the mothers and by drainage from the placental end of the umbilical cord. Samples of cord blood were obtained at delivery of an additional 21 women of similar lower socioeconomic status in the maternity hospital of the Guatemalan Social Security System. Mothers with illnesses or obstetrical complications were excluded. Thirty days after delivery, a second blood sample was obtained from 20 of the same women chosen equally from each of the two socioeconomic groups. Serum cholesterol levels were determined in all samples by the method of Abell et al.[7] adapted in this laboratory to be performed with 0.05 ml. of serum.

For comparison with information already available for women in the upper socioeconomic group,[8] dietary data were obtained from the ten women selected for postpartum blood sampling from the lower socioeconomic group. Each woman was interviewed daily for one week to determine her food consumption pattern. The calorie, protein, and total fat content of the diets was calculated using the food composition table prepared by INCAP.[9] For the estimation of the dietary fatty acid content the tables of Hardinge and Crooks[10] and Hayes and Rose[11] were used.

RESULTS

As shown in Table I, the total serum choles-

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TABLE I

Body Weight and Serum Cholesterol Levels of Newborn Infants from Mothers of Two Different Income Levels in Guatemala City

Group	Males					Females				
	Cholesterol (mg./100 ml.)			Birth weight (gm.)		Cholesterol (mg./100 ml.)			Birth weight (gm.)	
	No. of Cases	Mean	S. D.*	Mean	S. D.	No. of Cases	Mean	S. D.	Mean	S. D.
Upper income	8	52	16	3650	451	13	65	18	3283	354
Lower income	20	56	8	3063	414	24	71	21	2916	363

*Standard deviation.

terol levels of the newborn infants gave no indication of significant differences among babies born to mothers of the two groups. The combined values for both sexes were 60 mg. for those in the upper income group and 63 mg./100 ml. for those in the lower income group. Nevertheless, the newborn infants of the mothers in the upper socioeconomic group were consistently heavier than those of mothers in the lower socioeconomic group.

The differences in serum cholesterol levels between sexes, were significant ($P < 0.01$)*; the males had a tendency to lower levels (averages of 52 and 56 mg./100 ml.) than females (averages of 65 and 71 mg./100 ml.). In both groups newborn male babies appeared heavier at birth than female babies, a difference which was more apparent in the upper socioeconomic group.

The cholesterol levels for selected samples from the two groups of mothers at parturition and 30 days afterwards are shown in Table II. In the upper socioeconomic group there was a slightly higher mean serum cholesterol concentration at the time of delivery, 255 mg., compared with 231 mg./100 ml., but this difference was not statistically significant. There is no indication of a significant correlation between the mother's serum cholesterol level at parturition and the level observed in their children at birth ($r = 0.15$, 42 D.F.). In women in the lower income group there was a significant decrease postpartum in serum cholesterol levels from averages of 238 to 202 mg./100 ml. For women in the upper income group the values of

* The difference observed still proved significant after due consideration of the heterogeneity of variances.

TABLE II

Serum Cholesterol Levels (mg./100 ml.) of Guatemalan Mothers in Two Different Income Groups

Group	At Delivery			30 days Postpartum		
	No. of Cases	Mean	S. D.*	No. of Cases	Mean	S. D.
Lower income	23	231	48	10	202	71
Upper income	21	255	59	10	246	18

* Standard deviation.

255 at delivery and 246 mg./100 ml. thirty days later showed essentially no change.

The estimated daily dietary intake of women in the socioeconomic groups studied are shown in Table III. In the lower income group, fat furnished 20 per cent of the total caloric intake and in the upper income group 37 per cent. In both groups 96 per cent of the total fat intake

TABLE III

Estimated Daily Dietary Intake of Guatemalan Women

	Lower Income Group	Upper Income Group
Calories	1906	2475
Proteins (gm./day)		
Animal origin	22	39
Plant origin	39	31
Fats (gm./day)		
Animal origin	25	46
Plant origin	18	55
Per cent of calories derived from fat	20	37
Fatty acids (gm./day)		
Saturated fatty acids	16	35
Unsaturated fatty acids	24	58
Oleic acid	17	46
Essential fatty acids	6	9

was accounted for in the calculation of the fatty acid composition of the diet. The saturated fatty acid content was much higher in the diets of the upper socioeconomic group. Although the unsaturated fatty acid content was also greater in the same group, this fraction was mainly oleic acid. The ratio of saturated fatty acid to essential fatty acid was 4.0 in the upper income group and 2.7 in the lower socioeconomic group. The amounts of protein of animal origin in the diets of mothers in the upper income group were also much greater than those of the mothers in the lower socioeconomic group, although there was little difference in their total protein consumption.

COMMENTS

In contrast to the differences in serum cholesterol levels reported for Guatemalan school children in various socioeconomic groups,[6] the average serum cholesterol levels of children at birth do not vary with socioeconomic status according to the data presented. Moreover, the values in the newborn are very low as compared with those previously found in children and adults. At birth cholesterol values appear to be higher in females than in males, although no sex differences in serum cholesterol levels were observed in school children.

The finding that serum cholesterol values in the newborn are independent of their mothers' cholesterol levels, agrees with the reports of Slemon and Stander[12] and Bersohn and Wayburne.[13] Similarly, in newborn children of European and African mothers in South Africa[13] there was no significant difference in serum cholesterol levels in spite of marked differences in the mothers' cholesterol levels, dietary intake and socioeconomic status. These results are presumably due to the fact that the placenta is relatively impenetrable to fat and lipids. As Slemon and Stander[12] suggest, fetal fat is probably synthesized from glucose which is freely supplied by the mother to meet the demands of her offspring.

Changes in serum cholesterol must take place at a relatively early age, since differences among the various socioeconomic groups may be marked by the time children have reached school age. It is probable that the differences begin soon after weaning, but this needs confirmation by direct observation. The values reported for newborn infants are, in almost all studies, much lower than those of adults, but there is no agreement as to the rate of increase. Gordon and Cohn[14] demonstrated that the average serum cholesterol level at birth was about 89 mg./100 ml., remaining stationary in the first week of life, increasing during the first year to 136 mg. and reaching a value of 169 mg./100 ml. by the sixth year. Similarly Offenkrantz and Karshan[15] have noted a gradual rise in the cholesterol level in plasma from the age of two months to levels essentially the same as reported for adults, at seven years. Sperry,[16] on the other hand, reports that after a pronounced increase during the first four days of life, the serum cholesterol levels tend to remain constant. Hodges et al.[17] report no significant differences in serum cholesterol values between children and adults, and describe values of 200 mg./100 ml. in children two to six months of age. All these studies were made in the United States. The values reported in Sweden by Josephson and Gyllensward[18] for newborn infants are higher than those of other investigators[14,19–21] and are also at variance with the values described in this paper.

Although a comparison of the serum cholesterol values of pregnant women with those of nonpregnant women of the same age and socioeconomic status indicated that serum cholesterol levels in both groups tended to become elevated during pregnancy, the increase was more pronounced in the lower socioeconomic group in which the levels were low to begin with. Mothers of both socioeconomic groups, selected at random, also showed a decrease in total serum cholesterol one month after parturition, although this observed reduction in serum cholesterol levels was significant only for the mothers in the lower socioeconomic group. Oliver and Boyd[22] had previously reported that cholesterol values in pregnant women return to nonpregnant levels by five months after parturition. Obviously the failure to find a significant difference between maternal values in the two socioeconomic groups at parturition is due to the smaller increase during pregnancy in the group with higher initial values.

SUMMARY

Serum cholesterol levels of 37 newborn girls (68 mg./100 ml., S.D. 20) in Guatemala City were significantly higher than those in 28 newborn boys (55 mg./100 ml., S.D. 11). Although two different diets were studied, no tendency was observed for the infant's serum cholesterol levels to be related to the mother's, socioeconomic group, diet or serum cholesterol levels at parturition. Serum cholesterol levels rose during pregnancy in the mothers of both groups but the increase was more pronounced in the lower socioeconomic group. A corresponding drop in cholesterol was observed 30 days postpartum in the mothers in each group, but proved statistically significant only for those in the lower income category.

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Nutrition in High Environmental Temperature

A Survey of the Literature*

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Environmental conditions are important factors which influence the course of metabolic processes. An alteration in the environment is followed by a change, not only in the intensity but also in the character of metabolic processes. It is natural that there is also a change in the demands of the organism with respect to nutrition.

The present survey will review the data contained in the literature concerning nutrition in high environmental temperature, both artificial (heating chambers of various types) and natural (subtropical, tropical and desert conditions). In spite of the significant differences of these conditions, in both cases the essential element apparently is the factor of high temperature, which produces similar (although not identical) changes in metabolism.

Many investigations have established that under conditions of high temperature essential changes arise in the water-salt balance, in the metabolism of albumins, fats, carbohydrates and vitamins. Thus, as a result of abundant perspiration, a significant quantity of water, salt, vitamins and amino acids is excreted. With these metabolic changes, it might be expected that people living in or working under conditions of high temperature would be found to have certain definite characteristics in nutrition and taste, which appear to be the result of a gradually developing adaptation.

Almost all authors,[1–5] who have studied the nutrition of people who have lived for a long time under conditions of high temperature, mention a significant decrease of appetite in these people. At the same time many investigators have also called attention to the unique dietary regimen under these conditions. Thus, Kassirskiy[2] wrote: "Observations... show that Uzbeks, Turkmens and Tadzhiks, living in the hottest zone, eat rather oddly: for in the course of a whole day they sustain themselves on flat cakes with tea and sugar,

Editorial note: In 1956 the National Institutes of Health of the Department of Health, Education, and Welfare established a Russian Scientific Translation Program. The objective is to acquaint the American scientist with Russian medical-biologic research.

As part of the program a number of scientific articles have been translated for republication in English-language periodicals. We take pleasure in presenting the following article (published originally in *Voprosy Pitaniia* [*Problems in Nutrition*] 15(6):3, 1956), which has been altered only to conform more closely to the American idiom. It is hoped that this service will not only give American workers some idea of the current thinking of their Russian counterparts but also add a bit to international understanding.

* Original Russian title: Pitanie v usloviiakh vysokoi temperatury vneshnei sredy.

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A limited number of tearsheets of this article will be available from the National Institutes of Health, Russian Scientific Translation Program, Bethesda, Md.

while transferring the main meal (meat stew, goulash, etc.) to the evening when it turns cool, so that in the evening they eat (as one could not help noticing) with great appetite." A similar experiment in dietary management in Central Asia was reported by Latyshev in 1933. Gordin and associates[5] studied the nutritional habits of employees who worked under hot conditions in metallurgical factories. The same type of dietary management was found to be prevalent there; i.e., the workers ate a light meal at noon and a heavy meal one to two hours after they had finished work.

Investigators mention that there is a decrease in the demand for food under conditions of high temperature. Johnson and Kark[6] came to this conclusion after studying the nutrition of soldiers in tropical and arctic areas. Dohnoffer and Vonotsky[7] in experiments on white mice also observed a decreased intake of food under conditions of high temperature and an increased intake at a low temperature; Johnson and Kark[6] noticed a relative increase or decrease in the demand for fats, protein and carbohydrates in people living under various conditions of temperature. However, Czechoslovakian investigators[8] have pointed out that workers in hot shops at metallurgical factories showed a preference for fats and fatty foods (about 40 per cent of the calories in their ration is made up of fats). Spealman and associates[9] in their study also mentioned that, when there was a free choice of food, the people living under conditions of high temperature demanded more fats than those living under conditions of normal temperature.

The special characteristics of the nutritional management and appetite of people living under conditions of high temperature can be explained principally through investigation of the secretory activity of the digestive glands.

Novi[10] and Adol'f[3] observed that under conditions of a high environmental temperature there was a decrease in salivation. A reduced secretion and a decrease of acidity in the gastric juice were noticed under similar conditions by Müller and Hölscher,[11] Gel'man and Sheveliukhin,[12] Sheveliukhin,[13] M. L. Èidinova,[14] Putilin and Staritskaia,[15,16] and Timofeev,[17] observed a reduced discharge of juice from the pancreas. An increase in the periodic secretion was noted by Grinberg,[18] and an inhibition in the discharge of intestinal juice in response to mechanical stimulation with a simultaneous lowering of the quantity of ferments secreted in a unit of time was recorded by Samoilenko.[19]

A more detailed study of the secretory activities of the stomach and pancreas under the influence of high temperature and of a physical load was carried out by Putilin and Staritskaia.[15,16] They showed that secretion in dogs was inhibited most sharply when they were fed in a warm chamber or immediately before they were placed there. After coming out of the chamber, inhibition of secretion was observed for an hour. These investigators noticed that under the influence of heat there is principally an inhibition of the complex-reflex phase of secretion and, to a lesser degree, of the chemical phase.

Under the influence of high temperature, apparently, the excitability of the nutritive center is lowered. This is indicated not only by the reduction of secretion in the complex-reflex phase of the discharge of gastric juice[14,15] but also by the significant decrease of appetite in people and of nutritive excitability in animals under conditions of high temperature.

According to the data of Lat,[20a] the decrease in appetite under conditions of high temperature is to a considerable extent caused by thirst. The stimulation of the drinking center inhibits the center which regulates the acceptance of solid food. Lat established that when thirst was produced in animals by any cause, by conditions of high environmental temperature, by deprivation of water or by introduction of a hypertonic solution of salt, the demand for food was sharply reduced. The author concludes that under conditions of high temperature it may be possible to combat loss of appetite by lowering the stimulation of the drinking center (by drinking often, but in small quantities).

With reference to these data it is possible to understand why animals and people who work under conditions of high temperature eat

more heavily during the cooler hours of the day when the appetite is restored and the secretion of digestive juices returns to normal. It is also possible to understand why workers in hot factories eat bitter, spicy and highly seasoned foods which stimulate the appetite and secretion of digestive juices.[5]

As is well known, conditions of high temperature are generally accompanied by abundant perspiration. Over a period of 24 hours, a total of $10^1/_2$ to $13^1/_2$ quarts of perspiration may be secreted. It has been established that through perspiration the human organism loses not only water and salt but also vitamins and amino acids in quantities sufficient to decrease the balance of these substances and thereby the vital activity of the organism.

The replacement of water lost appears to be necessary for the existence of an organism in high temperatures. Adol'f,[3] in his observations on people living under desert conditions, came to the conclusion that during intense perspiration it was advisable to ingest an unlimited quantity of water, regulated only by thirst. The author considers it useful to drink even more than one wants to. Such a regimen of drinking maintains water balance, ensures a sense of well-being and a capacity for work.

According to Kalmykov and Eronin[20b] perspiration under conditions of high temperature takes place at approximately the same rate regardless of whether or not water is ingested; however, a decrease in the intake of liquids lowers the capacity for work and impairs the sense of well-being. The authors conclude that the amount of perspiration is determined principally by the heat balance of the organism, and depends to a significantly smaller degree on the quantity of liquid ingested.

The investigators quoted consider it inadvisable to limit the amount of liquid ingested under conditions of high temperature.

These investigators do not discuss the question of the more rational arrangement of the taking of liquids as regards time or the methods by which beverages, which are recommended for use in high temperature conditions, might be available. These questions will now be considered.

The losses in salt by perspiration, which may reach 18 gm. in twenty-four hours, must be replaced. When there is a deficiency of salt in the organism under conditions of heat, the temperature of the body is swiftly raised and a significant increase in the pulse rate sets in.[21,22] The data of Heilbrunn, Harris, LeFevre, Wilson and Woodward,[23] regarding the special role of salt under conditions of high temperature, are of interest. According to the data of these investigators, the toxic factor S (a thrombin-like substance) is produced in the tissues of animal organisms under the influence of heating. The introduction to intact animals of extracts from the muscles, blood and other organs of animals which have been subjected to heating, produces in the former the picture of overheating. The authors conclude that this toxic substance is produced in large quantities when there is a deficiency of sodium and a surplus of potassium; the presence of adequate quantities of sodium in the organism ensures the destruction of the toxic substance. As evidence of this theory, Heilbrunn and his colleagues cite the successful therapeutic action of salt in cases of heat stroke, burns and also in general overheating of the organism.

A series of investigators[24–27] have shown the advisability of adding 0.5 to 1 per cent of salt to water which is to be ingested under conditions of high temperature. However, the experiments of Aref'eva and her associates[28] have shown that in cases in which perspiration under conditions of high temperature does not exceed 3 to 4 L. per twenty-four hours, the ingestion of water with salt added has no advantage over fresh water, since signs of a deficiency of chlorides are not apparent. Liquids to which salt has been added are justified in those cases in which perspiration losses reach 7 L. Similar conclusions have been reached by other investigators.[29,30] Johnson et al.[31–33] established that almost all the soluble vitamins (ascorbic acid, riboflavin, thiamine, pantothenic acid, biotin, nicotinic acid, pyridoxin, para-aminobenzoic acid, inositol, choline) can be isolated in the composition of perspiration. With increased perspiration under conditions of high temperature,

there is naturally also an increase in the losses of these vitamins. Johnson and his colleagues came to the conclusion that the losses in soluble vitamins through perspiration, even when there was abundant perspiration, were not great enough to produce a deficiency of them in the organism.

The data obtained from the studies of Iakubovich[34] and Maĭkova[35] are of a different kind. Iakubovich[34] has established that furnace-workers lose 18 mg. of vitamin C and 0.37 mg. of vitamin B_1 through perspiration during each shift. Incipient signs of hypovitaminoses in these workers decreased and vanished after the administration of 200 mg. of vitamin C and 10 mg. of vitamin B_1 daily.

Maĭkova[35] established that bakers in bread factories lose 0.35 to 5 mg. of vitamin PP and from 0.5 mg. (in March) to 0.05 mg. (in June) of vitamin B_2 per shift. Tests using large doses of vitamins B_2 and PP showed that the setback and, hence too, the deficiency of these vitamins in the bakers was considerably larger than in workers who labored under conditions of a normal temperature.

It was also established that under conditions of high temperature the isolation of vitamin C in urine increases sharply up to 15 to 29 mg. per day.[36]

However, the increased demand for vitamins under conditions of high temperature is probably caused not only by the loss of them through perspiration, but also by the change in the intensity of metabolic processes. Thus the experiments of Mills,[37] and of Mills, Cottingham and Taylor[38] demonstrate the increased demand for thiamine and choline in animals which are subjected to high temperatures, and which are unable to control thermoregulation by means of perspiration (rats and chicks). The increased demand for B vitamins in rats under conditions of high temperature was observed by Cherkes,[39] and also by Gol'dshteĭn and his associates.[40] Vinokurov[41] observed a decrease in the content of vitamin C in the organs of animals subjected to overheating. Martini[42] showed that the introduction of ascorbic acid increases the stability of animals under the influence of high temperatures. Animals which had been subjected to overheating and had received ascorbic acid lived longer than animals which had not received a supplement of ascorbic acid. Matusis[43] established that the overheating of guinea pigs leads to an increased quantity of albumins in the blood, but that the preliminary administration of ascorbic acid prevents the development of similar changes.

According to the data existing in the literature, it may be concluded that it is advisable to increase the content of the B vitamins and of vitamin C in the diets of people living for a long time under conditions of high temperature.

Hans, Kral and Zeniśek[44] have studied the amino acid constituent of human perspiration. Chromatographic research has shown that the content of amino acids in the perspiration increases after work, but that their composition is significantly different from the composition of free amino acids in the serum. The content of threonine in the perspiration seemed to be particularly high. The authors state that losses in threonine through perspiration are so significant that their role in the nutrition of the appropriate groups of workers, and also of sportsmen ought to be studied.

Kabanov and Ravkin[45] studied the influence of a different content of albumins in the diet on the human organism under conditions of high temperature. They investigated the effect of two diets, one of which they called "normal" and the other "albuminous." Both the subjective situation of the people under observation and the objective data definitely showed that the "albuminous" diet was more effective. These data served as a basis for the recommendations by certain hygienists that under conditions of high temperature, food should contain a large quantity of albumin. However, investigation of the composition of the diets recommended by the authors reveals that the people under observation did not in practice receive a "normal" diet, but rather a diet with a low albumin content, since the content of albumin in it constituted only 8 to 9 per cent of the total calories (according to the physiologic norms,

the content of albumin ought to be 14 per cent). The second diet (the albuminous) contained 20 per cent of albumins, somewhat exceeding the physiologic norm. Kabanov and Ravkin[45] point out that even their "albuminous" diet did not appear to contain optimal requirements since it produced heightened excitability in the people under observation.

These authors suggest that the albumin-optimum for workers in hot factories be somewhere in between the values of the "normal" and "albuminous" diets, i.e., between 8 and 20 per cent, and therefore approximately at the physiologic norm (14 per cent) for people who work under conditions of normal temperature. On the basis of these investigations, it seems that the only conclusion which may be drawn is that under conditions of high temperature a deficiency of albumins produces a negative effect upon the organism.

By the end of the 19th century, a series of investigators had established that under the influence of heat there is an increased loss of nitrogen from the organism, and a heightened decomposition of albumins.[46–49] Similar data were obtained in observations on people working in laboratories in a study by Razenkov[50] and also by Molchanova and her colleagues.[51] Molchanova, who studied the nitrogen balance of people living in a hot climate, concluded that it was essential to raise the albumin content in their diet basically by reducing the rich albumins of animal origin. With the aim of compensating for the heightened decomposition of albumins, it was recommended that instead of 122 gm. of albumins per twenty-four hours (in accordance with the physiologic standards for a daily calorie-content of 3,500 calories) 140 to 150 gm. should be administered. In later works (1952) the author recommends a less significant increase in albumin content: to 130 gm. (instead of 122 gm.), i.e., instead of 14 per cent the albumins ought to constitute 15 per cent of the daily diet. Such an increase in albumin content does not produce significant changes in the constitution of the diet.

However, because of the significant and specifically dynamic action of albumins, certain investigators consider it inadvisable to increase their content in diets under conditions of high temperature.[53–55]

In experiments on animals Polezhaeva-Shifman[56] established that under conditions of high environmental temperature a large quantity of albumins in the food shows an even more negative effect than does albumin deficiency. In accordance with these studies, the optimum quantity of albumins under conditions of high temperature has narrow, strictly defined limits—not only a minimum but also a maximum limit.

Also concerning the question of albumin metabolism in the organism are the data of Razenkov,[50] Georgievskaia,[57] Mittel'shtedt and Novakovskaia,[58] Novakovskaia,[59] and Sverdlova[60] regarding the effect of sugar on gaseous and nitrogenous metabolism in man under the influence of high environmental temperature. Under these conditions, the introduction of sugar into the organism in the form of a 1 per cent aerated water solution containing also 0.5 per cent salt normalizes the urea-forming function and reduces the quantity of amino acid and creatinine which can be extracted from the urine. These data indicate that under conditions of high temperature, sugar assists the reutilization of the products of albumin disintegration and regulates the urea-forming function.

In the opinion of these authors the most perfect drink for workers in hot factories is water aerated with carbon dioxide which contains 1 per cent sugar and 0.5 per cent salt.

Not many studies have been conducted on the question of the demand of the organism for fats under conditions of high environmental temperature.

We have already mentioned the observations of the Czechoslovakian investigators,[8] carried out in the Institute of Research on National Nutrition (Prague), in relation to the nutrition of workers in hot factories. It was established by them that such workers consumed a considerable quantity of fats (about 40 per cent of the calorie value of the daily diet). Experiments have shown that fats do not impair but enhance the preservation of water.[61] With a diet rich in fats (36.5

per cent of fats) the water content in the liver of experimental rats and mice increased. Under conditions of high temperature these animals drank less than mice and rats which received normal nutrition. In the opinions of the authors, this occurrence is due to the fact that fats are an endogenous source of water.

The observations of Danilov[62] are of interest; they draw attention to the property of fats to retain water in the organism; if on the eve of the day of the experiment a large quantity of fats is introduced into the organism, the diuresis on the following day is appreciably lowered.

Closely related to the problem of the nature and management of the diet under conditions of high temperature, is the question of the management of fluids. We shall only touch on works which deal directly with interrelation of the nutritional factor and that of the management of fluids.

We have already referred to the studies by Razenkov,[50] in which it was established that aerated water containing salt and 1 per cent sugar or glucose is much more effective than simple water or aerated water with salt added because of its influence on nitrogenous metabolism and other indications of the condition of the organism. Khvoinitskaia[63] proposed a drink for workers in hot factories which she calls an albumin-vitamin drink. This drink contains salts of sodium, calcium, potassium and phosphorus in concentrations isotonized as regards their content in plasma, B vitamins, vitamin C, albumin 0.2 per cent, sugar 2 per cent and organic acids. According to the data of the author, when this drink was ingested by the workers in hot factories, perspiration decreased 20 to 35 per cent, muscular capacity for work increased, and there was a normalization of the evacuational and an increase in the secretory functions of the stomach. In the light of these investigations, the introduction of vitamins, salts and sugar into such a drink seems to be completely justified.

Through the studies of Danilov[62] and his colleagues[64–68] it was established that a close relationship exists between the digestive processes and the water used in the organism. Danilov[62] and Sadykov[66] showed that the increase in acidity in the gastric juice, produced under conditions of high temperature, leads to a more frequent opening of the pyloric sphincter. At the same time liquid swiftly leaves the stomach, fills the bowels, is swiftly absorbed, and causes abundant diuresis. It was established by Danilova[65] that in such conditions the liquid portion of food moves swiftly into the bowels, whereas the solid portion remains in the stomach for a long time, thereby inhibiting the secretion of gastric juice. When, under conditions of overheating, gastric juice is added to the drink (1 teaspoon to a glass of water) diuresis is sharply reduced. Thoroughly boiled gastric juice did not show such an action. Hydrochloric acid need not be present to produce this effect of the gastric juice. Liquids which show a good juice-producing action, preserve moisture longer in the organism and reduce abundant diuresis. These effects were noticed in using decoctions or juices of cabbage, beetroot, infusions of sweet briar and oleaster[67,68] and green tea.[66] Pankova[64] established that gastric juice and pancreatic juice and bile, acting on the mucous membrane of the loop isolated by Tiri-Vella, strengthen the secretion of intestinal juice and simultaneously slow down the absorption of water-salt solution. Therefore, the preference for drinks with a juice-producing effect is obvious; they are preserved longer in the organism because of their gradual passage from the stomach and slower absorption in the intestine.

This action explains the effectiveness of a cherry drink which was used for workers in hot factories.[29] The effectiveness of the cherry drink as compared with aerated salted water, was studied by Iusupov. The cherry drink caused a decrease in the discharge of perspiration of 26.7 to 31.5 per cent, a decrease in the use of liquids of 28.5 to 35.7 per cent, and a decrease in the body temperature of 0.3 to 0.6 per cent by comparison with these same indicators during the use of aerated salted water.

Therefore it is possible to understand the wide usage of liquids which stimulate gastric

secretion, such as bitter bread-cider, cold buttermilk, fruit juice, tea (particularly coca tea in Central Asia), and fruit concoctions, which are widely used for the quenching of thirst.

Venchikov[69,70] established that the length of time that water is retained in the organism also depends on the rate at which liquids are ingested. Intensity of perspiration was recorded by measuring the electric conduction of the skin. The author showed that when 200 ml. of liquid is ingested in ten to fifteen seconds, the onset of perspiration is rapid, whereas if the same quantity is ingested gradually over the course of thirty minutes, the onset of perspiration is much slower. The author mentions the fact that the native inhabitants of Asia during the heat prefer to drink tea, which they drink in small gulps. Experiments showed that with the ingestion of tea, perspiration is more moderate.

Kenney[71] in studies of people in a heating chamber observed that a man drinking small doses of water frequently (100 ml.) will drink 300 to 400 ml. less water in the course of one and a half working hours than a man drinking large quantities of water (1,000 ml.) at a time. As has already been pointed out, Lat[20] believes that frequent drinking in small doses (since it lowers the stimulation of the drinking center) maintains the stimulation of the food center, and consequently also maintains the appetite.

According to the data of Frank,[72] the temperature of water from 25 to 70 degrees does not affect the intensity of perspiration. However, the temperature of water ingested does influence the intensity of metabolism. In observations on people it was shown that when drinking 250 ml. of water at a temperature of 17 degrees during exercise, the gas interchange rose (the absorption of oxygen increased by 30 per cent). When the same quantity of water at a temperature of 45 degrees was ingested, the oxygen demand decreased by 30 per cent.[73] The introduction of water of a different temperature directly into the stomach did not affect the intensity of the gas interchange. The internal ingestion of cold water (17 degrees) produces a lowering of the discharge of water from the skin, and the ingestion of warmer water (45 degrees) produces an increase.[74]

During a long stay under conditions of high temperature, the following may be considered advisable and justifiable: (1) a rearrangement of the dietary management; (2) an increase in the dietary content of the B vitamins (B_1, B_2 and PP) and vitamin C; (3) the retention of the albumin content on a level with the physiologic norms which are accepted for given expenditures of energy; (4) the use of foods with a high salt content (herrings, pickles, etc.), and also of bitter and spicy appetizers and dishes which stimulate the secretion of digestive juices; (5) the use of liquids which stimulate the secretion of juice and maintain salts, sugar, vitamins (similar to the albumin-vitamin drink of Khvoinitskaia[63]); and the ingestion of liquids in small doses.

It seems important to ascertain the demand of the organism under conditions of high temperature for fats, isolated amino acids (threonine) and microelements.

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Nutrition News

Lectures on Applied Nutrition and Metabolism

The Home for the Jewish Aged, Philadelphia, in cooperation with the Committee on Nutrition and Metabolism of the Philadelphia County Medical Society and the National Vitamin Foundation, is sponsoring a series of lectures on nutrition and metabolism as they relate to specific medical problems in the aged.

On October 11, 1959, Dr. Robert W. Hillman, New York, will discuss "The Geriatric Patient —Nutritional Requirements."

On November 11, 1959, Dr. Herbert Pollack, New York, will speak on "General Therapeutic Nutrition with Emphasis on Obesity."

On December 9, 1959, Dr. Richard W. Vilter, Cincinnati, will present the topic of "The Relation of Nutrition to Cardiovascular Disease."

Symposium on Prenatal Nutrition

A symposium on Prenatal Nutrition will be sponsored by the Department of Obstetrics of the Johns Hopkins Hospital and the Department of Biochemistry of the School of Hygiene and Public Health, the Johns Hopkins University, under the chairmanship of Drs. Nicholson, J. Eastman and Bacon F. Chow, to be held in Hurd Memorial Hall of the Johns Hopkins Hospital, on October 16 and 17, 1959. The meeting will be informal in nature.

Nutrition in Pregnancy

The Council on Foods and Nutrition of the American Medical Association announces that five papers presented at the Symposium on Nutrition in Pregnancy in Columbia, Missouri, in October 1957, have been prepared in monograph form. This monograph is available without charge by writing to the Council, American Medical Association, 535 North Dearborn Street, Chicago 10, Illinois.

Nutritio et Dieta

A new European journal, *Nutritio et Dieta*, devoted to the study of nutrition in man, will begin publication this year.

The journal, a quarterly, will cost $7.20 per annum. Further information may be obtained from the publisher, S. Karger AG, Arnold-Böcklin-Strasse 25, Basel, Switzerland.

Borden Award of the Nutrition Society of Canada

The Borden Award of the Nutrition Society of Canada will be given annually in recognition of outstanding research work done by one of the members of its Society. The first award will be made in June 1960. The recipient of this award, which has been donated by the Borden Company Foundation, Inc., must be under the age of forty years and the meritorious work must have been published within the preceding three years. It is hoped that this award will further encourage research activities by younger members of the Society.

Council on Arteriosclerosis

The Council on Arteriosclerosis of the American Heart Association–American Society for the Study of Arteriosclerosis will hold its Thirteenth Annual Meeting on November 8 and 9, 1959, at the Hotel Knickerbocker, Chicago, Illinois.

Reviews of Recent Books

The Birth of Normal Babies, by Lyon P. Strean. Twayne Publishers Inc., New York, 1958, pp. 194, $3.95.

The author has a theory. He believes that "stressful situations," which include anything from overeating and starvation to hay fever and minor accidents, cause the excessive production of cortisone in the body, which in turn can produce abortions, stillbirths and congenital anomalies.

The book consists of an anecdotal compilation of information to support this and, "as a guide to radiant and blessed motherhood," "ten commandments" which recommend that the mother avoid such things as disease, injury, emotional stress and strong drugs during early pregnancy and that she "take multivitamin tablets or capsules daily, particularly high dosage of vitamins B_6, B_{12} and C."

Nobody will dispute the obvious sense of avoiding accidents and disease at any time, but there is no evidence that they can, except in well known and exceptional instances, cause abortion, stillbirth, or abnormality. And it is ridiculous to suggest that vitamins can offer any protection against accidents.

What will be the feelings of the average pregnant woman who reads the book and then, inevitably, remembers some "stressful situation" she has experienced in the first weeks? She will have a terrifying wait until the baby is delivered, with only vitamin capsules for her comfort. No good can be said of this book; it cannot be condemned too strongly.

F. E. HYTTEN

Ciba Foundation Symposium on the Neurological Basis of Behaviour, edited by G. E. W. Wolstenholme and C. M. O'Connor. Little, Brown & Company, Boston, 1958, pp. 400, $9.00.

This symposium was called to mark the centenary of the birth of Sherrington, and had representation from Australia, Belgium, Canada, England, France, Sweden, Switzerland, South Africa and the United States. The fields represented were anatomy, electrophysiology, biochemistry, pharmacology, neurology and neurosurgery. As is customary in symposia of this nature, the formal presentation of papers was followed by general, informal discussion. In this symposium, not only were the formal presentations of a high order, but the discussions which followed each presentation were also uniquely interesting and instructive.

Much new material was presented on the behavior of nerve cells. A series of papers was presented on the behavior of animals in which the diencephalon, the reticular system, thalamus and rhinencephalon were stimulated. Other papers dealt with the behavior of animals following discrete lesions in the thalamic nuclei, and the effects of drugs in altering behavior. Valuable contributions were made to an understanding of the functions of the temporal lobe and the rhinencephalon. Ingenious experiments were reported whose purpose was to study the neurologic basis of responses to stress and of conditioned reflexes. The many-sided approaches to the problem of the neurologic basis of behavior included a study of brain enzymes. Significantly, the last paper of the symposium dealt with the interpretation of some human behavior disorders on the basis of the available neurophysiologic data. Much time and work will, of course, be needed to elucidate further the complexities of psychiatric behavior on an organic physiologic basis, but a significant beginning has been made as shown by the findings reported in this symposium. H. M. ZIMMERMAN

Disease of Metabolism, fourth edition, by Garfield G. Duncan. W. B. Saunders Company, Philadelphia, 1959, pp. 1,104, $18.50.

The fourth edition of this standard and excellent text reveals a number of major changes from previous printings. Several chapters have been completely rewritten; for example, Salter on protein metabolism, Strang on obesity and Welt on fluid and electrolytes. The revisions have been extensive throughout, and much very current material is included, such as data on lipoic acid, glucagon and tolbutamide. The type is set in the convenient two-column format, and the numerous references and extensive index enhance the usefulness of the book.

Little can be added in a review except to repeat that this is probably the most complete and authoritative text on the subject in the English language. This edition continues the tradition of excellence established by the "Duncan" since 1942.

This reviewer was interested to see what is included in "Metabolism." As expected, there is full coverage of nutritional subjects (e.g., vitamins, minerals, obesity, undernutrition) in addition to endocrine subjects (e.g., thyroid, diabetes insipidus as well as mellitus) together with "metabolism" such as gout, porphyrinemia, galactosemia and melituria. The fusion of nutrition, endocrinology and traditional nutrition

in this book also reflects the concept of this Journal, and the need to tear down the artificial semantic curtain between consanguineous relatives. S. O. W.

Recent Progress in Hormone Research, edited by Gregory Pincus. Academic Press Inc., New York, 1958, pp. 582, $13.50.

The Laurentian Hormone Conference for 1957 was a remarkable congregation of authorities delving into a wide range of chemical, metabolic and biologic investigation. Among the diverse topics contained in the edited text are hormone structure and function, hormones in growth and development, reproduction, hormones and metabolism, and neurohumors. The chemical and biologic aspects of the 16-hydroxylated corticoids were analyzed by Bernstein demonstrating the lack of sodium retention without loss of glucocorticoid activity by these new compounds. Drill and Riegel presented studies on a variety of new steroids including nortestosterone derivatives, progestin factors, estrogen and antiestrogen compounds, and aldosterone-blocking substances. Huggins reported on the application of steroid compounds to the problem of inhibition of growth of mammary carcinoma. An interesting account of the mechanism of action of estrogen was presented proposing interaction between the hormone and cell enzymes.

Of particular interest to nutritionists and those of allied fields are the sections by Leathern on hormones and protein nutrition, and Gassner et al. on effects of hormones on growth, fattening and meat production potential of livestock. A new method of hormone treatment using a paste form of combinations of stilbesterol and testosterone was reported to increase live weights to 72 pounds per head offering marked economic advantage. The effect of hormones upon human serum lipoprotein was outlined by Eder. It was emphasized that the effects of gonadal hormones on lipoproteins are so specific that they might be used for estimation of these substances in man. Dorfman and Schiller have prepared an encyclopedic view of the hormonal influences upon connective tissue. New data pertaining to the synthesis, metabolism and distribution of the catechol hormones was presented by the most distinguished authority in this field, Von Euler.

The unrivaled position of this text in the field of endocrinology makes it required reading for those with interests touching upon the subjects contained within it. C. R. SCHUMAN

Annual Review of Medicine, volume 10, edited by David A. Rytand. Annual Reviews, Inc., Palo Alto, Calif., 1959, pp. 448, $7.00.

The 1959 edition of this annual summary of medical practice contains an interesting chapter on nutrition by G. H. Berryman. In addition to reviews of the major fields of medicine, special attention is given to salmonellosis, transfusions and environmental medicine.

The terse descriptions can give only a sketch of the important work now going on in diverse fields. But the selection of the highlights are indeed useful to either the general reader or the scholar in search of a "reference." As we have in the past, we again congratulate the contributors on performing an arduous task remarkably well. S. O. W.

Indiana Diet Manual, a project of the Indiana Shared Dietitian Project. C. E. Pauley and Co., Indianapolis, Ind., 1958, pp. 68, $1.00.

This manual was developed by a committee of dietitians to meet the needs of the small hospitals without the services of a trained dietitian. An attempt was made to simplify all terminology and to arrange the information in such a manner that the untrained food manager would have little difficulty understanding and planning meals to fit normal as well as therapeutic diets.

The therapeutic diets which were included are those most often ordered and are outlined in detail so as to be of help to the staff physician as well as the kitchen or diet supervisor.

The booklet is small and contains only the diet outlines with basic instructions. There are no food tables giving detailed food values, but then it is not meant to be a textbook. The reviewer believes that the title of the manual is inadequate. A better title might be "Diet Manual for the Smaller Hospitals." The booklet is recommended as one which could be of great benefit to the small institution without trained dietary supervision.

It may be obtained from Mrs. K. Sheedy, Chairman, Indiana Shared Dietitian Project, Lilly Clinic, Marion County General Hospital, Indianapolis 7, Ind. A. E. S.

A Textbook of Medicine, tenth edition, edited by R. L. Cecil and R. F. Loeb, W. B. Saunders Co., Philadelphia, 1959, pp. 1,665, $16.50.

In the thirty-two years since the first edition of "Cecil," this textbook has stood among the best general works of its kind—surely some sort of record. As every one probably knows this book has had many contributors, each writing from experience on their chosen subject. The tenth edition has 164 contributors and a roster reading like a "who's who" in medicine. A slight change in format has improved readability. An excellent and complete index concludes the massive volume.

Deficiency diseases are covered by Youmans, Spies, McIntosh, Weech and Wollaeger. Disorders of metabolism, including such diverse topics as obesity, diabetes, agammaglobulinemia and fluid balance, are discussed by an equally distinguished group. (It is of some interest that "atherosclerosis" is classified as a metabolic disease.)

Many of the discussions are exceedingly brief but all are succinct and lucid. The student as well as the advanced scientist will continue to use this revised standard text for solid reference material. S. O. W.

The Family Medical Encyclopedia, by J. J. Schifferes. Little, Brown & Company, Boston, 1959, pp. 617, $4.95.

This book is an alphabetical listing of medical terms which are defined and described in varying detail. It is written for "the average reader" and makes use of a greatly simplified language, including a number of slang and popular terms (e.g., "tired blood," "clap," etc.). A number of drugs are listed by their brand names; for example, Miltown, Orinase, Luminal, etc.

Most of the descriptions, although possibly irritating to a medical pedant, are adequate for their purpose. The difficulties in describing various symptoms, illnesses, and physiologic processes in lay terms are great, and this fact is generally appreciated. Some may take legitimate exception, however, to the statement that folic acid is "related to but not identical with vitamin B_{12}; it is especially useful in treating pernicious anemia." This reviewer is unfamiliar with the basis for the statement that young children often get carsick because they cannot see out of the windows of a moving vehicle. In addition, the current treatment of celiac disease is no longer a reduction of fat and sugar.

Certain topics receive special attention, and several pages are devoted to each of such topics as ear trouble, heredity, Blue Cross, teeth, vaccines. Much good medical advice is presented and, together with certain rather clear descriptions, makes for a useful family medical encyclopedia. S. O. W.

Books Received

Books received for review by The American Journal of Clinical Nutrition are acknowledged in this column. As far as practicable, those of special interest are selected, as space permits, for a more extensive review.

Handbook of Diet Therapy, third edition, by Dorothea Turner, University of Chicago Press, Chicago, 1959, pp. 222. $5.00.

Proteins in Foods, by S. Kuppuswamy, M. Srinivasan and V. Subrahmanyan, Indian Council of Medical Research, New Delhi, pp. 290, Rs. 12.

Food Values in Shares and Weights, second edition, by Clara Mae Taylor, The Macmillan Co., New York, 1959, pp. 116, $4.00.

The Mast Cells, by James F. Riley, E. & S. Livingstone, Edinburgh, 1959 (Williams & Wilkins, exclusive American agents), pp. 182, $6.75.

ABC für Zuckerkranke: Ein Ratgeber für den Kranken, by F. Bertram, Georg Thieme Verlag, Stuttgart, 1959, pp. 88, DM 4.20.

Ciba Foundation Symposium on Carcinogenesis: Mechanism of Action, edited by G. E. W. Wolstenholme and Maeve O'Connor, Little, Brown & Co., Boston, 1959, pp. 336, $9.50.

Ciba Foundation Symposium on the Regulation of Cell Metabolism, edited by G. E. W. Wolstenholme and Cecilia M. O'Connor, Little, Brown & Co., Boston, 1959, pp. 387, $9.50.

Clinical Evaluation of New Drugs, by S. O. Waife and Alvin P. Shapiro, Paul B. Hoeber, Inc., New York, 1959, pp. 223, $7.50.

Steroids, by Louis F. Fieser and Mary Fieser, Reinhold Publishing Corp., New York, 1959, pp. 945, $18.00.

Alcoholism—The Nutritional Approach, by Roger J. Williams, University of Texas Press, Austin, 1959, pp. 118, $2.50.

The Truth About Your Eyes, by Derrick Vail, Farrar, Straus & Cudahy, New York, 1959, pp. 180, $3.50.

Nutritional Diagnosis, by Grace A. Goldsmith, Charles C Thomas, Springfield, Ill., 1959, pp. 164, $5.50.

Our Food, by M. Swaminathan and r. K. Bhagavan, Ganesh & Co. (Madras) Private Ltd., Madras, India, 1959, pp. 88.

Trace Element Problems in Nature—A Symposium, edited by K. H. Schutte, University of Cape Town, Rondebosch, Africa, 1959, pp. 55.

The Arterial Wall, edited by Albert Lansing, Williams & Wilkins Co., Baltimore, 1959, pp. 259, $7.50.

Food: The Yearbook of Agriculture 1959, edited by Alfred Stefferud, The U. S. Government Printing Office, Washington, D. C., 1959, pp. 736, $2.25.

Abstracts of Current Literature

CHARLES R. SHUMAN, M.D., EDITOR

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ASCORBIC ACID DEFICIENCY

Enhanced requirements for vitamin C during various types of stress including surgery have been described. In the latter condition, this vitamin is of importance because of its role in the formation of ground substance and collagen necessary for firm wound healing.

Ascorbic Acid Economy in Surgical Patients as Indicated by Ascorbic Acid Levels. J. H. Crandon, B. Landau, S. Mikal, J. Balmanno, M. Jefferson and N. Mahoney. *New England J. Med.*, 258: 105, 1958.

Ascorbic acid requirements, effects of deficiency and significance of blood ascorbic acid levels were studied in adult surgical patients. A patient was considered deficient if the plasma level of ascorbic acid was lower than 0.2 mg./100 ml. and was associated with buffy-coat ascorbic acid level below 8 mg./100 gm. Ascorbic acid levels were determined in forty-seven patients with postoperative wound dehiscence. Nineteen were considered deficient. In a maintenance study it was found that most patients after surgery could be maintained on 100 mg. of ascorbic acid daily if there was not a marked inflammatory reaction. One patient with severe enterocolitis required 300 mg. daily. Surgical operations generally caused a fall in plasma ascorbic acid levels in patients who had high or saturated blood levels. The fall was much less pronounced in patients with low ascorbic acid levels.

A correlation was found between low levels of plasma ascorbic acid and increased urinary excretion of "tyrosyl" after a 30 gm. dose of L-tyrosine. When ascorbic acid was administered the amount of tyrosyl excreted returned to normal. M. W. BATES

The development of scurvy within ten days after operation is very remarkable. Earlier studies have shown that three months or more of total vitamin C deprivation is necessary to produce early symptoms with hemorrhages following later. Further investigation of the phenomenon of purpura in these cases is warranted.

Scurvy Following Bilateral Adrenalectomy. D. Chamberlain and N. V. Addison. *Brit. M. J.*, 2: 1128, 1958.

The authors have seen a number of cases of scurvy following bilateral adrenalectomy and oophorectomy for carcinoma of the breast. Two of these are described in detail. Purpuric spots developed about ten days after operation and a vitamin C saturation test showed a deficiency in both. There is a brief discussion about the curious and still obscure relationship between the high content of vitamin C in the adrenal gland and the corticosteroid hormones. F. E. HYTTEN

The bleeding phenomena of scurvy is probably fostered by toxicity associated with intercurrent infection and metabolic changes together with the impairment in mucopolysaccharide formation with wall of the capillary bed. These changes may be late in their occurrence or inhibited by more effective treatment of infection.

Adult Scurvy. R. H. Cutforth. *Lancet*, 1: 454, 1958.

Adult scurvy is thought to be sufficiently rare in Britain for single cases to be reported but in this account eleven cases seen during six years at two London hospitals are described. There were ten men and one woman, aged from forty-eight to eighty-two years. All lived on solely vitamin C-deficient diets.

Chief symptoms were aching limb pains, usually described as "rheumatic," lethargy, anorexia and mental depression, and the main signs were bruising and anemia. Gum bleeding, which the textbooks emphasize, was present in only one case. F. E. HYTTEN

Haemorrhagic Pleural Effusion as a Manifestation of Scurvy. W. Rozner and J. Lloyd. *Lancet*, 1:393, 1958.

As more reports are published about cases of scurvy in Britain, the more exceptions appear to the classic descriptions of the disease. A sixty-two year old man is described who had lived largely on a "carbohydrates and boiled fish" diet because of a gastric ulcer. He was twice admitted to the hospital with a hemorrhagic pleural effusion. He had some skin bruising but his edentulous gums were healthy. Scurvy was eventually diagnosed and with the use of ascorbic acid the man recovered rapidly. F. E. HYTTEN

Impairment of carbohydrate tolerance in scorbutic animals is established through several studies. The defect is corrected by the administration of insulin, and it does not involve the transport of fructose or galactose into cells. These observations suggest a deficiency in the activity of insulin although this has not been demonstrated directly. These experimental findings do not have a precise clinical counterpart.

Utilization of Glucose, Fructose and Galactose by Scorbutic Guinea Pigs. S. Banerjee and E. R. Divakaran. *Am. J. Physiol.*, 195:291, 1958.

The utilization of glucose, fructose and galactose was studied in scorbutic and paired fed normal guinea pigs by performing tolerance tests with these sugars, and by determining the glycogen contents of the liver and skeletal muscle of these animals. After feeding glucose, the blood glucose of scorbutic guinea pigs attained a markedly higher peak and showed a delayed fall compared with that of normal guinea pigs. Ingestion of fructose was accompanied by an appreciable rise in the true blood glucose of scorbutic and normal guinea pigs. Administration of galactose did not elicit any such elevation of blood glucose. The amounts of fructose and galactose found in the blood of scorbutic guinea pigs at different intervals after administration of the respective hexoses were essentially the same as in normal guinea pigs. Ascorbic acid deficiency did not seem to disturb the utilization of fructose and galactose by guinea pigs. The glycogen contents of the liver and muscle of scorbutic guinea pigs were reduced markedly and did not differ significantly following ingestion of glucose, fructose or galactose. The disturbed carbohydrate metabolism in scurvy is attributed partly to diminished formation of glucose-6-phosphate from glucose. AUTHORS

Studies on Carbohydrate Metabolism in Scorbutic Guinea Pigs. S. Banerjee, D. K. Biswas and H. Devendra Singh. *J. Biol. Chem.*, 230:261, 1958.

Scorbutic guinea pigs were found to have decreased glucose tolerance, lower liver and muscle glycogen levels, and increased concentrations of citric, malic and lactic acids in tissues. These changes were all corrected toward the normal values by prolonged administration of insulin in gradually increasing doses up to 0.3 unit/100 gm. daily. The blood content of α-keto acids was also increased in scorbutic animals and returned toward normal values by insulin, but no changes were seen in the α-keto acid content of liver, kidney or brain. It is claimed that ascorbic acid deficiency appears to result in a metabolic block in the tricarboxylic acid cycle below the level of citrate, and in reduced glycogenesis. Since treatment with insulin reversed much of the carbohydrate metabolism disturbance, it was suggested that lack of insulin may be a major cause of the abnormal carbohydrate metabolism in scurvy. M. K. HORWITT

The evaluation of ascorbic acid upon fluoride metabolism involves the handicap of rapid and extensive changes occurring in dental structures and skeleton in the guinea pig. It is possible that increased growth in ascorbic acid-supplemented pigs is responsible for increased storage of fluoride.

Effect of Vitamin C on Skeletal Fluoride Storage in the Guinea Pig. J. C. Muhler. *J. Am. Dent. A.*, 56:335, 1958.

Young male guinea pigs weighing between 170 and 190 gm. were used to study the effect of vitamin C on the storage of fluorides in the skeletal system after different levels of fluoride administration. The vitamin C-deficient diet was composed of ground oats, powdered skim milk heated at 110°C. until brown, Wesson oil, cod liver oil and sodium chloride. The fluoride content of the diet was approximately 3 p.p.m. Both the diet and essentially fluoride-free drinking water were fed *ad libitum*. Four series of guinea pigs were used that differed with regard to the amount of vitamin C and fluoride provided and also in the duration of the trial. Throughout these series, the increased intake of vitamin C resulted in an increased storage of fluoride in the skeleton. This observation was true when no fluoride was provided beyond that which was present in the diet as well as when supplements of fluoride as large as 2 mg. were fed per day. For example, in series 2 which had a duration of twenty-three days, the guinea pigs fed only the scorbutic diet had a concentration of 317 p.p.m. of fluoride per gram of carcass ash and a total of 1.91 mg. of fluoride in the entire carcass. The guinea pigs which received a 125 mg. of vitamin C in addition to the scorbutic diet had a concentration of 629.2 p.p.m. of fluoride and a total accumulation of 5.44 mg. In the same series, the guinea pigs that received the 2 mg. supplement of fluoride in addition to the scorbutic diet had a concentration of 3,683 p.p.m. and a total accumulation of 21.87 mg. The guinea pigs that received both the 2 mg supplement of fluoride and the 125 mg. of vitamin C had a concentration of 3,756 p.p.m. and a total accumulation of 30.10 mg. To some extent the increased total storage of fluoride is attributable to the increased body weight of the vitamin C supplemented guinea pigs and hence the greater skeletal weight. The extent to which the increase in

skeletal weight influenced the total fluoride storage cannot be determined from the data. The fact that the fluoride concentration per gram of ash increased with the vitamin C supplementation is likely to be a more accurate index of the influence of vitamin C on the formation of bone ash. In many of the vitamin C supplemented groups, there was an unusually poor rate of growth which is suggestive of some other deficiency than vitamin C. This growth problem is further accentuated in some groups such as in series 4 in which there were sharp losses in body weight at times in the life history when maximum growth would be expected.

J. H. SHAW

The high content of ascorbic acid in the adrenal cortex has been regarded as an important factor in steroidogenesis by this organ. However, the adrenal cortex of the scorbutic animal has been noted to maintain its ability to produce steroidal hormones. Apparently the same capacity for androgen production by the gonads in the scorbutic animal is not preserved.

Cytochemistry of Male Reproductive Tract in Scurvy and Inanition. B. P. Kocen and L. F. Cavazos. *Proc. Soc. Exper. Biol. & Med.*, 98: 485, 1958.

In scurvy, degeneration of germinal epithelium and of Leydig cells occurs. In order to determine whether or not these changes are specifically due to vitamin C deficiency or to inanition the following groups of experiments were carried out in young male guinea pigs: (1) a vitamin C-deficient diet was fed *ad libitum*, (2) a vitamin C-deficient diet supplemented with ascorbic acid was fed in *ad libitum* quantities, (3) a vitamin C-deficient diet supplemented with ascorbic acid was fed in amounts restricted to the intake of the scorbutic animals, (4) a vitamin C-enriched diet was given. The animals were observed from four to five weeks, when the typical scorbutic symptoms were fully developed in the animals of group 1. Testes, epididymis and seminal vesicles were studied microscopically and histochemically with particular reference to the content of glycogen and ascorbic acid. Both inanition and avitaminosis C decreased the amount of cellular glycogen. Apparently avitaminosis C causes an inability to utilize essential dietary substances thus leading to cachexia as seen in inanition. Scorbutic, but not the undernourished, animals failed to show vitamin C in the Leydig cells; this may be related to decreased androgen production in the degenerating cells.

M. SILBERBERG

Metabolic Products of L-Ascorbic Acid. P. C. Chan, R. R. Becker and C. G. King. *J. Biol. Chem.*, 231: 231, 1958.

Studies with labeled L-ascorbic acid support the hypothesis that L-dehydroascorbic acid is a major intermediate in the metabolism of ascorbic acid toward carbon dioxide, oxalate, L-xylose, L-xylulose, glucose and glycogen. Ascorbic acid-1-C^{14} was largely converted to $C^{14}O_2$ by guinea pig liver slices and by liver homogenates in the presence of either cytochrome *c* or ascorbic acid oxidase. Decarboxylation of L-dehydroascorbic acid and the production of $C^{14}O_2$ was largely dependent on the presence of the supernatant fraction, in contrast to the terminal ascorbate oxidation system which is known to be present in the mitochondria. Formation of oxalic acid-C^{14} was independent of the presence of liver tissue. On the other hand, ascorbic acid -2,3,4,5,6-C^{14} yielded negligible amounts of $C^{14}O_2$, but labeled xylose, xylulose and glucose were isolated from the reaction mixture following incubation with guinea pig liver slices. Glycogen formation in guinea pigs from uniformly labeled L-xylose was three and a half times as great as that from L-ascorbic acid -2,3,4,5,6-C^{14}. Ascorbic acid -3,4,5,6-C^{14} injected into guinea pigs yielded liver glycogen with glucose labeled mostly in the 1 to 5 positions in proportions theoretically expected if much of the ascorbic acid were metabolized by way of xylose, xylulose and the pentose cycle. These findings support the hypothesis that L-xylose is an intermediate in the formation of glucose from L-ascorbic acid.

M. K. HORWITT

ANEMIA AND NUTRITION

Macrocytic anemia associated with anticonvulsant drug therapy cannot be attributed to absorption defects involving folic acid or vitamin B_{12}. The condition responds to treatment with folic acid. The problem of the effect of these agents upon nucleoprotein biosynthesis deserves further study.

Macrocytosis and Macrocytic Anemia Caused by Anticonvulsant Drugs. C. F. Hawkins and M. J. Meynell. *Quart. J. Med.*, 27: 45, 1958.

Macrocytosis is described in one-third of seventy-two epileptic patients, of whom 34 per cent were receiving phenobarbital therapy alone. Serum vitamin B_{12} levels were normal and there was no hematologic response to vitamin B_{12} injections. The mean corpuscular volume fell toward normal when folic acid was given, even though no defect in folic acid absorption was found.

Macrocytic anemia was comparatively rare, and, of eight patients described, all had been receiving phenytoin or primidone. Epithelial lesions in the mouth were frequent, hemorrhagic tendencies may occur and peripheral neuropathy or posterolateral column involvement were found in two patients. The condition always responded to the administration of folic acid, but vitamin B_{12} therapy was less often successful. The authors conclude that anticonvulsant drugs affect nucleoprotein synthesis, thus leading to macrocytosis, which occasionally progresses to macrocytic anemia.

W. H. J. SUMMERSKILL

The megaloblastic anemia of pregnancy is generally regarded as being of nutritional origin with particular ref-

erence to a deficiency in folic acid activity. The precise cause of the defect is not recognized but the response to treatment with this agent is usually gratifying.

Megaloblastic Anaemia of Pregnancy and the Puerperium. C. Giles and E. M. Shuttleworth. *Lancet*, 2: 1341, 1958.

Of 3,199 women delivered at two hospitals in Stoke-on-Trent, England, 474 had a hemoglobin level of 9.5 gm./100 ml. or less and were specially investigated; of these patients 374 were "late bookings" or emergency admissions. Investigations included examination of sternal marrow, serum iron and dietary history. Ninety of these 374 women had a megaloblastic marrow picture, an exceptionally high incidence of one in thirty-nine deliveries.

The peripheral blood picture was usually normocytic; megaloblasts and nucleated red cells were rarely seen. Hemoglobin levels ranged from 12 to 65 per cent and seven of the eight patients with a hemoglobin level below 30 per cent were megaloblastic.

There was a peak reticulocyte response of 10 to 20 per cent in most cases within five to ten days of starting treatment with folic acid. Serum iron levels, initially high in most cases of megaloblastic anemia, fell with treatment. Additional tests performed in a proportion of subjects suggest a high incidence of achlorhydria and some showed diminished fat absorption. The disease showed some association with high parity and multiple pregnancy; there was no seasonal incidence. Pre-eclamptic toxemia and obstetric hemorrhage (both undefined) occurred excessively in women with anemia. The diet was said to be poor in 42 per cent of these women, particularly with respect to meat.

F. E. Hytten

Treatment of pernicious anemia with parenterally administered vitamin B_{12} is so effective that it is difficult for some to accept the recommendations for oral therapy, which may be uncertain, or the addition of folic acid, which is unnecessary.

Folic Acid and Vitamin B_{12} in Pernicious Anemia. J. S. Will, J. F. Mueller, C. Brodine, C. E. Kiely, B. Friedman, V. R. Hawkins, J. Dutra and R. W. Vilter. *J. Lab. & Clin. Med.*, 53: 22, 1959.

In this interesting study thirty-six patients with pernicious anemia, receiving 30 mg. of folic acid three times a week, were followed for a period of years. Only three patients were maintained in a satisfactory hematologic and neurologic state for ten years. Most of the relapses occurred in the first four years. The patients who had never had vitamin B_{12} or liver therapy seemed to have earlier relapses. Those patients who remained in a satisfactory state on folic acid had very low serum levels of vitamin B_{12}, and minute amounts of this vitamin would reverse the neurologic changes in those with this type of relapse. This group was compared with another group of patients with pernicious anemia, who had received an average of only 0.7 μg. of vitamin B_{12} per day, and had remained in good health. Data on the effect of administered vitamin B_{12} on urinary vitamin B_{12}, folic and folinic acid excretion in some of these patients are interpreted by the authors as supporting the idea that vitamin B_{12} effects folic acid metabolism by releasing folinic acid from tissue, by promoting the reduction of folic acid to folinic acid, or by the formation of the N^{10}-formyl derivation of reduced folic acid.

G. Hollifield

Oral Treatment of Pernicious Anemia with Vitamin B_{12} and Purified Intrinsic Factor. A. Killander. *Acta med. scandinav.*, 160: 339, 1958.

An oral preparation of vitamin B_{12} combined with purified hog intrinsic factor was given to twenty-four patients with pernicious anemia, four of whom were in relapse. Hematologic investigations and serum vitamin B_{12} estimations were performed regularly during treatment periods of between fifteen and thirty-nine months. The patients in relapse responded well, but during prolonged treatment ten subjects relapsed after a mean period of twenty-one months. In an additional nine patients subnormal serum vitamin B_{12} levels developed without anemia, so treatment was reliable in only five patients. Such treatment is therefore unsafe at present for maintenance, unless regular serum vitamin B_{12} concentrations are estimated, as a fall in this value invariably precedes clinical or hematologic relapse.

W. H. J. Summerskill

Amino-Acid and Protein Metabolism in Pernicious Anaemia. D. W. Neill and J. A. Weaver. *Brit. J. Haemat.*, 4: 447, 1958.

A number of metabolic disturbances have been demonstrated in subjects with pernicious anemia and the present authors have already demonstrated disturbances of amino acid excretion. In the present paper thirty subjects with untreated pernicious anemia have been studied. Twenty-four-hour samples of urine were subjected to chromatographic analysis and the serum proteins examined by electrophoresis.

There was an increased urinary excretion of amino acids, of no constant pattern, and an increased excretion of taurine. The serum protein concentration was reduced, particularly albumin. It is believed that these findings support the view that vitamin B_{12} is important for protein synthesis in man.

F. E. Hytten

Hypochromic iron deficiency anemia is frequently associated with hypochlorhydria. The latter condition is attributed to atrophic gastritis, the cause of which is obscure but favors the development of anemia by limiting the maintenance of dietary iron in the ferrous state for absorption.

Gastric Mucosal Lesions Before and After Treatment in Iron Deficiency Anemia. F. Lees and F. D. Rosenthal. *Quart. J. Med.*, 27: 19, 1958.

Achlorhydria with gastric mucosal changes of atrophy or gastritis are commonly associated with iron deficiency anemia, but whether these abnormalities are the cause or the result of the anemia is uncertain. The authors investigated this problem by studying the histology of specimens of gastric mucosa obtained by gastric biopsy in twenty-one women with iron deficiency anemia not due to gastrointestinal hemorrhage. Histamine test meals were also performed and both investigations were repeated after the anemia had been corrected with iron therapy.

The initial biopsy was normal in only two subjects, the remainder showing superficial or deep infiltration, and atrophic changes were present in eleven patients. Nine of fourteen patients had achlorhydria. A year after successful treatment, the histologic changes had deteriorated in eight patients and none showed improvement. Two more patients had become achlorhydric and in none did acid reappear. These data, together with other work, suggest gastric mucosal lesions precede the anemia and in some way favor the development of iron deficiency.

W. H. J. SUMMERSKILL

Blood-volume in Chronic Nutritional Anaemia. P. W. G. Tasker. *Lancet*, 1: 807, 1959.

There is little published information about changes in blood volume in anemia. In this study plasma volume was measured by Evan's blue dye and the red cell mass estimated from the packed cell volume in seventy-four subjects who hematologically were normal or who had chronic nutritional anemia, some with a hemoglobin level of less than 2 gm./100 ml.

The blood volume fell progressively with intensification of the anemia, but the fall was due almost entirely to the red cell mass; the plasma volume remained essentially constant. Hence the more severe the anemia, the more misleading is the hemoglobin concentration as a measure of the total circulating hemoglobin. "In the most severe degrees of anaemia the error was as much as 50 per cent too high." F. E. HYTTEN

NOTES ON VITAMIN A

Excessive ingestion of vitamin A has become an important matter for investigation. Acute and chronic poisoning with the vitamin has been more frequently recognized in recent years. The large amounts of vitamin A found in many vitamin preparations available over the counter and by prescription should be reappraised as to their possible long term toxic effect. An effect of hypervitaminosis A upon the parathyroid glands of animals which has been described is probably mediated through changes in calcium metabolism.

Late Effects of Hypervitaminosis A in the Rat. Disturbance and Retardation in the Normal Growth of Offspring. C. C. Berdjis. *Arch. Path.*, 66: 278, 1958.

Pregnant rats were fed a stock diet supplemented with crystalline vitamin A dissolved in corn oil, the daily dose being 500,000 I.U./gm. at a level of 100 to 300 I.U./gm. body weight. This diet was fed before, after and during pregnancy. It had harmful effects on the offspring only when fed during pregnancy. There was a decrease of the number of litters and a 60 per cent mortality among the young. After reaching the age of four months, the offspring showed retardation of growth, weight loss, dry skin and roughening of the hair. Microscopically, the skeleton disclosed lacunar fibro-osteoclasis; there was associated hyperparathyroidism and metastatic calcification of interval organs, particularly of the kidneys.

M. SILBERBERG

Parathyroids in Hypervitaminotic A Rats. C. C. Berdjis. *Acta Vitaminol.*, 4: 151, 1958.

Four groups of young rats, averaging thirty-five days of age, were fed with excessive doses of vitamin A, and three untreated groups served as controls. The parathyroid glands were examined in all the groups one to four weeks after treatment. The data obtained showed increase in volume and changes in morphologic characters. The parathyroids were more compact and rich in rounded cells. These changes were interpreted as moderate hyperplasia, presumably due to skeletal defect consisting, as described previously, of generalized but moderate lacunar fibro-osteoclasia.

AUTHOR

Conversion of carotene to vitamin A occurs in the mucosal cells of the small intestine and not in liver as formerly believed. It is believed that the simple splitting of the beta-carotene molecule may give rise to two molecules of vitamin A.

Effect of Beta-Carotene and Cortisone on Vaginal Epithelium of Vitamin A Deficient Rats. E. G. Rice and W. J. Bo. *Proc. Soc. Exper. Biol. & Med.*, 98: 877, 1958.

Female rats of the Wistar strains about twenty days old were placed on a vitamin A-deficient diet. After three weeks, when vaginal smears showed cornification of the epithelium characteristic of the deficiency, the animals were given one of the following treatments for ten days: (1) oral administration of 6 to 480 μg. of beta-carotene daily; (2) 2.5 mg. of cortisone acetate; (3) 2.5 mg. of cortisone with a supplement of 6 to 480 μg. carotene; and (4) cortisone for three days prior followed by combined administration of 12 to 48 μg. of carotene and cortisone. The symptoms of vitamin A deficiency in the vaginal epithelium disappeared when beta-carotene was given alone or in combination with cortisone. Carotene alone did not reverse the changes

due to vitamin A deficiency, and it was therefore concluded that the hormone has no effect on the conversion of beta-carotene to vitamin A. M. SILBERBERG

Both hepatic and Kupffer cells store vitamin A with a significant excess of the vitamin usually being available. Prolonged deprivation is possible without effect upon serum levels.

Experimentelle Untersuchungen über Vitamin-A-Speicherung. W. Riechert and W. Weber. *Ärztl. Forsch.*, 12: 1, 1958.

By means of the paper chromatographic method it is possible to differentiate vitamin A derivates, such as palmitate, acetate and alcohol. It was noted that when the palmitate, alcohol and acetate were administered to white rats, the lungs, the walls of the small intestine, and especially the liver, store the vitamin A in the form of palmitate. However, there is no correlation between the vitamin A level in serum and that in the liver. By this method, no vitamin A-alcohol could be identified in the serum and in the liver.

AUTHORS

Serum Cholesterol Determinations as Affected by Vitamin A. L. J. Kinley and R. F. Krause. *Proc. Soc. Exper. Biol. & Med.*, 99: 244, 1958.

High levels of vitamin A give excessive values with the Zak ferric chloride method for the estimation of serum cholesterol but do not interfere with the Schoenheimer-Sperry saponification-extraction method. Although more time-consuming, the latter method is to be preferred for other reasons and is standard in most research laboratories. G. WALKER

Cretins have been noted to have low serum levels of vitamin A and relatively high levels of carotene. The treatment of thyrotoxicoses with vitamin A was recommended at one time, suggesting that the vitamin decreased the effect of thyroxine in stimulating metabolism.

The Role of Vitamin A in the Occurrence of Goitre on the Island of KRK, Yugoslavia. A. Horvat and H. Maver. *J. Nutrition*, 66: 189, 1958.

In several districts of the island KRK in Yugoslavia goiters are a frequent occurrence; they are more frequent in children above ten than in children under ten years of age; in girls they are seen somewhat more often (62 per cent) than in boys (54 per cent). An analysis of the water disclosed variation in the iodine content from 0 to 15.0 μg./L. There was no positive correlation between the deficiency of iodine and the occurrence of goiters within the various districts studied. It was, however, thought that lack of vitamin A or carotene may account for the occurrence of endemic goiter. Therefore 1,391 school children, 712 boys and 679 girls, seven to ten years of age were treated with 3,000 I.U. of vitamin A given daily for three months in the form of chocolate sweets. Studies of the vitamin A content in the blood serum showed a mean increase of 23 μg. per cent as over control subjects not receiving the supplement, the incidence of goiter decreased from 66 per cent to 37 per cent. Apparently vitamin A acts directly or indirectly in the formation of thyroid hormone.

M. SILBERBERG

Carotenemia is described in diabetes and myxedema but is probably not due to increased fat absorption in these states. The actual mechanism of the increased serum levels in these and other clinical states is unknown.

Observations on Carotenemia. The Lord Cohen of Berkenhead. *Ann. Int. Med.*, 48: 219, 1958.

The author presents a very short, concise review of a condition that is interesting, although rare, and of no clinical importance except as it might confuse the attending physician. The possible mechanism for elevated carotenoid pigments in the blood are listed as (1) excessive intake, (2) associated with hyperlipemia of any type, (3) failure of conversion of carotene into vitamin A and (4) failure of oxidation of carotene.

Excessive intake occurs in food faddists or other situations wherein the oral intake of green and yellow foodstuffs is excessive. The cause of the carotenemia associated with hyperlipemia states is less clear, except, of course, that the carotenoids are long chain hydrocarbons soluble in fat. Carotenemia due to inadequate conversion of carotene to vitamin A is an attractive hypothesis but in actuality must be exceedingly rare. The author presents some data on one patient which supports this concept. The last etiologic consideration again is in the realm of speculation. There is evidence that hypothyroidism is associated with elevated carotenoids and essentially normal vitamin A levels. This effect may be at the intestinal mucosal level where carotene is converted to vitamin A; however, there is no proof cited.

It is clear from this paper that actually very little is known concerning the metabolism of carotenoids. Their importance in fat metabolism *per se* would be worth pursuing. They have been used in some studies of experimental atherosclerosis, since their color puts a readily identifiable tag on them. Low serum levels are useful clinically in the diagnosis of malabsorption syndromes, as are tolerance tests with either carotene itself or vitamin A. J. F. MUELLER

FATS AND BLOOD COAGULATION

In each of the following papers an acceleration of clotting time has been observed following the administration of various types of fats or certain phospholipid fractions to human subjects. In one instance the removal of phospholipid did not alter the shortened coagulation time although one may surmise that endogenous phospholipid may have been produced rapidly upon absorption of fats into the enteric mucosa. It is of interest that physical activity negated the clot-accelerating effect of fat ingestion presumably by increasing the rate of fat oxidation.

Effects of Fat-Loading Upon Blood Coagulation. E. E. Mandel, H. L. Mermall, F. W. Preston and M. Silverman. *Am. J. Clin. Path.*, 30: 11, 1958.

The effect of ingestion of fat on blood coagulation has been described as a shortening by some investigators, but this has not been confirmed by others. The time that it takes after the fat meal for shortening of coagulation time to occur has also been a point of discrepancy. The present authors believed that parenteral induction of lipemia would be a good way to study the influence of lipemia on blood coagulation. Fat in the form of 15 per cent cottonseed oil was given intravenously to thirteen normal persons and to nine patients. Stypven plasma clotting time (SPCT), the clotting time of recalcified plasma treated with Russell's viper venom, (WBCT) tests were performed. Serum was analyzed for total lipids, phospholipids, cholesterol (which showed no significant change), and turbidity. A significant acceleration of WBCT and SPCT was observed with the normal subjects, but not in the patients (mainly postsurgical convalescent subjects). The validity of the shortening of clotting time was established by infusing six of the healthy subjects with glucose. No acceleration of coagulation time occurred by glucose infusion, as had been observed within four hours after fat infusion. There were no adverse clinical reactions in any of the subjects. The big question is whether lipemia, induced orally or intravenously, can precipitate thrombosis. Stypven plasma clotting time gives a crude index of the degree of lipemia, showing no discrimination between healthy and sick persons; however, this physiologic phenomenon cannot be interpreted as denoting an *in vivo* hypercoagulable state. Specific clotting factors involved and the clinical significance of the findings are yet to be determined. E. COHEN

In Vitro and In Vivo Effect of Different Fat Preparations on Blood Coagulation. J. F. Mustard. *Canad. M. A. J.*, 79: 818, 1958.

Lipids have been reported (*Lancet*, 2: 234, 1956) to inhibit or accelerate thromboplastin formation during blood coagulation. The authors tested the *in vitro* activity of butter, margarine, corn oil and cod liver oil in the thromboplastin generation test. Fats were fed to six fasting male subjects to determine *in vivo* effects by means of thromboplastin generation tests and Russell viper venom time (R.V.V.). Butter in 1:5 dilution was found to be as active as platelets or brain extract in the thromboplastin generation test. Margarine, cod liver oil and corn oil were inactive. Phosphatidyl serine added to butter could block the activity in thromboplastin generation. A phospholipid fraction containing phosphatidyl ethanolamine, if added to margarine made it as active as butter. Butter meals accelerated thromboplastin mechanism in some subjects, but not others. Butter plus phosphatidyl serine meals prolonged whole blood clotting time, but did not affect the thromboplastin mechanism except for depressing plasma Christmas-factor activity in some instances. However, margarine ingested with phosphatidyl ethanolamine accelerated thromboplastin generation as much as a butter meal in some subjects. Despite the variance in results, the authors believe that *in vitro* and *in vivo* effects of fats on blood clotting are primarily due to the phospholipid composition of the fat. Methods of study are still not reliable enough to evaluate the *in vivo* status of blood coagulation. E. COHEN

Comparison of Animal and Vegetable Fats in Increasing Blood Coagulability. G. A. McDonald and H. W. Fullerton. *Lancet*, 2: 598, 1958.

The subjects of this experiment were convalescent patients, twenty to sixty-one years of age with no history of cardiac disability. Blood samples were obtained three and four hours after one of two meals containing about 85 gm. of fat; in one meal the fat was primarily of animal origin, in the other primarily vegetable. There was a shortening of the clotting time of recalcified plasma after the fat meals and was of the same order, about 40 seconds at three hours, for both types of meal. The authors state "We have been unable to discover a satisfactory explanation for the failure of some workers to find a shortening after the ingestion of vegetable fat." F. E. HYTTEN

Effect of Physical Activity on Increased Coagulability of Blood after Ingestion of High-Fat Meal. G. A. McDonald and H. W. Fullerton. *Lancet*, 2: 600, 1958.

Medical students aged twenty to twenty-seven years were given a breakfast containing about 85 gm. fat. On a "sedentary" day they attended normal medical lectures and classes; on an "active" day they walked a total of about six miles at a moderate pace in the four hours after breakfast.

The shortened recalcified-plasma-clotting time associated with a high fat meal occurred on the "sedentary" days but there was no shortening on "active" days. F. E. HYTTEN

Egg-Containing Meals and Blood Coagulation. E. Orma, D. N. Rhodes and A. Keys. *Lancet*, 1: 388, 1959.

Recent experiments have suggested that the effect of egg in shortening the coagulation-time of recalcified plasma in the presence of Russell viper venom "Stypven-time", is due to its high phospholipid content.

In the present carefully planned trial nine middle aged men were given one of a number of meals, after a ten-hour fast, containing three eggs, three egg whites plus the total lipids of three eggs, three egg whites plus the lipids from three eggs without phosphatidyl ethanolamine, three egg whites plus egg lipids without phospholipids, three egg whites alone or a fat-free test meal.

The results are presented in detail. The total lipid of three eggs (about 13.5 gm.) produced a significant shortening of the "Stypven-time" and removal of the total phospholipid or phosphatidyl ethanolamine did not significantly alter the result. The whole blood

coagulation time in siliconised tubes was not significantly shortened by the ingestion of these quantities of egg lipids. F. E. HYTTEN

Effect of Glucose on Appearance of Plasma-Clotting Accelerator Activity, Lactescence and Plasma Lipids in Fat-Fed Dogs. J. H. Tilden and R. E. Shipley. *Circulation Res.*, 6: 804, 1958.

Normal dogs given 1.29 gm./kg. of peanut oil orally were bled at hourly intervals for seven hours and plasma lactescence and concentration of total lipid and phospholipid were measured. A modified Stypven clotting time was determined after pretreatment of plasma with barium sulfate and subsequently combined with dilute normal plasma "substrate." Increases in plasma lactescence were usually paralleled by acceleration of the modified Stypven clotting test. Moderate and irregular increases in total plasma lipids and phospholipids were observed at this level of fat ingestion.

When the same dogs were given glucose, 2.0 gm./kg. orally one-half hour before, with and hourly for four hours after the administration of peanut oil, hyperlipemia was negligible or absent, and there was no acceleration in clotting time.

When the glucose was given intravenously in the same amount and at the same times to fat-fed dogs, the appearance of hyperlipemia and clotting acceleration occurred approximately two hours later than when fat alone was given. No apparent correlation existed between plasma glucose concentration and lactescence or clotting acceleration. In most experiments moderate elevations in total plasma lipid and phospholipid concentrations were observed.

Heparin given intravenously in amounts sufficient to cause "lipemia clearing" with or without prolongation of whole blood clotting time had no detectable influence on clotting accelerator activity induced by fat feeding. AUTHORS

Sodium Polyethylene Sulfonate. Effects on Serum Lipids and Blood Coagulation. P. T. Kuo, F. T. Hopkins and H. Wurzel. *Circulation Res.*, 6: 178, 1958.

Sodium polyethylene sulfonate, given to twelve patients intramuscularly, 1 to 1.5 mg./kg., prolonged clotting time, lowered prothrombin and prothrombin consumption, and conspicuously lowered plasma Ac-globulin. The anticoagulant activity was slightly less than that of heparin in equivalent dosage.

Antilipemic activity was demonstrated in the plasma of all patients and was similar to that seen after equivalent doses of heparin. Fasting serum triglyceride levels remained unchanged. A relative increase in α-lipoprotein and a corresponding decrease in β-lipoprotein were seen in all ten patients studied, while serum cholesterol tended to decrease and serum phospholipids increased. W. H. ABELMANN

FLUORINE AND DENTITION

There is concern over the public apathy in the matter of fluoridation of water supplies, a situation aggravated by small but vocal groups opposed to this practice. Many observations have been made of the effects of fluoride upon the incidence of caries in population groups with uniform agreement upon its salutory effects. The local use of fluoride in dentifrice preparations apparently has equally salutory effects in children.

Caries-Inhibiting Value of a Dentifrice Containing Stannous Fluoride: Final Report of a Two Year Study. W. A. Jordan and J. K. Peterson. *J. Am. Dent. A.*, 58: 42, 1959.

Two separate studies were conducted over a two-year period to determine the effectiveness of a dentifrice containing 0.4 per cent stannous fluoride and 1.0 per cent stannous pyrophosphate. In the first study 190 children in the third and fourth grades of one school were supervised during the brushing of their teeth with the stannous fluoride dentifrice after lunch each schoolday; 215 children in the second school were supervised while they brushed their teeth with an identical dentifrice except that it did not contain the stannous fluoride or the stannous pyrophosphate. The children in both groups were encouraged to brush their teeth at home after each meal and during vacations with the respective dentifrices. In the second study, children at two other schools were paired and divided into two groups of 104 and 100 to use the same two dentifrices. However, in this case the children were given the dentifrices and brushes and encouraged to brush their teeth at home after meals and during vacations. The teeth of all four groups of children were examined clinically and with the aid of roentgenograms before the start of the studies and after one and two years.

In the first study, where supervision was provided, the children using the experimental dentifrice had 15.8 per cent fewer new decayed, missing and filled teeth and 20.5 per cent fewer new decayed, missing and filled tooth surfaces than the children in the control group. Both of these differences were statistically significant. It is interesting that the reductions during the second year of this study were much smaller than during the first year. No reason for the striking difference between the two years was evident from the data. In the second study, the children in the group with the unsupervised use of the experimental dentifrice, there were 15.9 per cent less new decayed, missing and filled teeth and 12.4 per cent less new decayed, missing and filled tooth surfaces than among the children in the group with the control dentifrice. These differences were not statistically significant due to the smaller group size and the higher standard errors that were observed in the second study. These differences are much less in both these studies than had been reported earlier by the Indiana investigators who developed the usage of stannous fluoride in tooth pastes. J. H. SHAW

Stannous Fluoride Clinical Study in Olmsted County, Minnesota. W. A. Jordan, J. R. Snyder and V. Wilson. *Pub. Health Rep.*, 73: 1010, 1958.

This survey of the effectiveness of the topical application of a freshly prepared 8 per cent solution of stannous fluoride to the surfaces of the teeth of a group of rural and village children in Minnesota was accompanied by an interesting series of classes for the children on dental health, nutrition and sanitation. This study is one of the first to have been conducted with stannous fluoride by an independent group of investigators from the group at Indiana who first reported stannous fluoride to be much more effective than comparable topical application of sodium fluoride. After a thorough preliminary oral examination, the children in both control and experimental groups were given a prophylaxis. Then a topical application of the stannous fluoride solution was made on all teeth of the children in the experimental group; a comparable application of water was made to all teeth of the children in the control group. The groups were well-matched with respect to past caries incidence, with the average number of decayed, missing and filled teeth of the children in the control group being 9.58 in comparison with 9.56 for the experimental group. After one year, the same dentist re-examined all children. The 238 children in the control group had experienced an average of 2.15 new carious teeth in comparison with 1.72 for the 234 children in the experimental group. This 20 per cent reduction was highly significant, with a "P" value of 0.005. The 14.4 per cent reduction in new carious surfaces experienced by the experimental group was less striking with a "P" value of 0.03. These reductions as a result of one treatment one year prior to re-examination are much less striking than those reported earlier by the Indiana investigators. At the time of the re-examination an additional topical application was made to the children in the experimental group with the intention of a third dental examination after an additional experimental year. J. H. SHAW

The distribution of fluoride in the skeleton and other tissues has been a matter of concern in view of the recommendations for the use of the halogen as a caries-inhibiting factor in public water supplies. In the experimental studies it is important to distinguish between the effects produced by pathologic levels and recommended or therapeutic levels of this agent.

Deposition of Fluoride in Soft Tissues Following Skeletal Saturation. M. J. Wagner, G. K. Stookey and J. C. Muhler. *Proc. Soc. Exper. Biol. & Med.*, 99: 102, 1958.

Weanling rats of the Sprague-Dawley strain were fed a stock diet supplemented by 1 mg. NaF given daily by stomach tube. Control animals were fed the stock ration only. At intervals of fifteen days up to 115 days the animals were sacrificed and kidneys, liver, heart, femur and sternum were analyzed for fluorine content. Even if fluoride contents of the bones had reached the saturation point, the soft tissue failed to exhibit any significant increase in the fluoride content. The fluoride content of the carcass increased markedly with the ingestion of the halogen, but the rate of retention decreased throughout the experiment and particularly after attainment of sexual maturity.

M. SILBERBERG

Rachitomimetic Effects of Fluoride Feeding on the Skeletal Tissues of Growing Pigs. L. E. Belanger, W. J. Visek, W. E. Lotz and C. L. Comar. *Am. J. Path.*, 34: 25, 1958.

The skeletal changes in fluorosis which are accentuated by calcium deficiency and resemble those seen in vitamin D deficiency or strontium rickets are characterized by deficiency of growth, bead-like swelling of the chondro-osseous junction of the rib, enlargement and softening of the epiphyseal plates, formation of osteoid and persistence of primary spongiosa. These changes are attributed to non-specific intoxication or intoxication mediated by the hyperparathyroidism. Male castrate Hampshire pigs six weeks old and weighing 65 pounds were raised on a normal farm ration and pair-fed. One animal of each set was placed on this diet supplemented by one part per 1,000 sodium fluoride. After thirty days each animal received one injection of 6 mc. of radioactive sulfur $S^{35}O_4$. Thereafter, pairs of animals were sacrificed at intervals varying from ten minutes to ninety days. Ribs and heads of the metatarsal bones were studied. As shown by autoradiographs, the tagged sulfate disappeared only slowly from the fluorinated cartilage. Microscopically production of an abnormal cartilaginous matrix was indicated by decreased stainability for polysaccharides. Accentuated deposition of mineral matter was seen in the matrix between the hypertrophic cartilage cells. Most of the mineral deposits seemed to be related to accumulation of organic calcium apparently loosely bound to chondroitin sulfate. M. SILBERBERG

The Effect of Fluoride Ingestion on the Organic Matrix of the Teeth of Growing Pigs. L. F. Belanger, W. J. Visek, W. E. Lotz and C. L. Comar. *J. Dent. Res.*, 37: 264, 1958.

The influence of the highly toxic level of 1,000 p.p.m. of sodium fluoride was studied in six-week old castrate male Hampshire pigs weighing sixty-five pounds. Six pigs were maintained on a normal farm ration, while another six were fed the same ration with this supplement. Equal intakes of food were consumed by the pigs in the two groups through a pair-feeding technic. After thirty days on experiment, each pig was injected intravenously with 6 mc. of radioactive sulfur as the sulphate. Pairs of pigs were sacrificed after ten minutes, five hours, twenty-four hours, ten, thirty and sixty days. Teeth and portions of the jaws were fixed for histologic evaluation.

The exposed portions of the teeth of fluoride-poisoned

animals did not exhibit any apparent difference in size when compared with the control animals. However, they were a dull chalky white in comparison with the opalescence of the teeth from the normal pigs. In addition, there was some mottling of the enamel and discoloration in the region of the cemento-enamel junction.

Histologic changes were more extensive in the incisors than in the molars, probably because the former were more rapidly growing. Dentin and cementum showed a graded decrease of staining by the periodic acid-Schiff technic and toluidine blue metachromasia. Predentin and cementum were hyperplastic, occasionally tumoral. The number of odontoblasts and cementoblasts was increased at thirty days and decreased after sixty days of fluoride ingestion. There was a definite hypervascularization in the pulp with a decrease in stainable ground substance. Round, clear masses, probably containing calcium fluoride, appeared in newly formed dentin and cementum of fluoridized animals.

These studies are interesting in helping to elaborate the mode of action of fluorides in gross excess. However, the fact that the toxicity here is the result of hundreds of times the levels of fluoride recommended for human consumption through water fluoridation should be remembered in order that there may be no confusion about potential human toxicity at low levels of fluoride ingestion. J. H. SHAW

Recovery of the Rat Kidney in Fluorosis. G. Lindemann, J. J. Pindborg and H. Poulsen. *Arch. Path.*, 67: 30, 1959.

In rats, fluorosis causes dilatation of Henle's loops of the renal medulla within three to four weeks. These changes are followed by destruction of tubules, chronic inflammatory reaction and fibrosis. In order to determine whether or not these changes are reversible after discontinuation of the fluoride salt, 2 to 2¼ month-old rats of the Wistar strain were fed supplements of 0.05 per cent of sodium fluoride for about two months and subsequently returned to a stock diet for periods of from 14 to 175 days and 91 and 384 days, respectively. With increasing duration of the period of recovery the "fluorosed" kidney showed less and less tubular damage, and near recovery was observed in those animals that were kept on the stock diet for about one year. Ultimately repair was complete except for fibrosis and small inflammatory foci leading to some granularity of the kidney surface. M. SILBERBERG

No evidence of impairment in skeletal development or functional disturbances were found in the presence of a high intake of fluoride in drinking water.

Excessive Fluoride in Water and Bone Chemistry. Comparison of Two Cases. F. J. McClure, H. G. McCann and N. C. Leone. *Pub. Health Rep.*, 73: 741, 1958.

Chemical analyses of the skeletal tissues of two female septagenarians are reported. One, subject A, lived for twenty-four years prior to death by heart attack in Washington, D. C. where the water contained 0.2 p.p.m. fluoride. The other, subject B, whose death was caused by a cerebral vascular accident, had lived for the preceding thirty-four years in Bartlett, Texas, where the drinking water contained 8.0 p.p.m. fluoride. The fluoride values of the bones of subject A ranged from 0.090 per cent for the femur to 0.185 per cent for the dorsal vertebra. The fluoride values of the bones of subject B ranged from 0.715 per cent for the fibula to 0.941 per cent for the rib sample and 0.966 per cent for the acromioclavicular joint. In the latter subject there was a suggestion that there had been a slight increase in the ash and calcium contents of the skeletal tissues. The absence of any gross or systemic findings or of any impairment of health or well-being, malformation of the skeletal tissues or malfunction in the subject who had consumed water containing 8.0 p.p.m. fluoride indicates that human bone is not affected when it contains levels of fluoride in the 0.7 to 1.0 per cent range.

J. H. SHAW

Fluoridation of Public Water Supplies and Its Relation to Musculoskeletal Diseases. C. L. Steinberg, D. E. Gardner, F. A. Smith and H. C. Hodge. *New England J. Med.*, 258: 322, 1958.

The body has two mechanisms to dispose of excessive concentration of fluorine: urinary excretion and skeletal deposition. A skeletal disease known as crippling fluorosis results from absorption of excessive amounts of fluoride for long periods of time. In order to see if a relation exists between rheumatoid spondylitis and crippling fluorosis the fluoride content of bone was measured in a patient with rheumatoid spondylitis. The fluoride concentration was normal. In another study the fluoride content in bones of patients with a variety of rheumatic disorders exposed to fluoridated water for a period varying from three years five months to four years seven months was compared to those in unfluoridated areas. Although the fluoride content was higher in those drinking fluoridated water, the difference was not statistically significant.

The total number of cases reported in this paper is small and the exposure to fluoridated water of a short duration. More studies will have to be made before any final conclusions can be made as to the effect of water fluoridation on fluorine content of bones.

M. W. BATES

Fluoride Deposition in Human Bones After Prolonged Ingestion of Fluoride in Drinking Water. I. Zipkin, F. J. McClure, N. C. Leone and W. A. Lee. *Pub. Health Rep.*, 73: 732, 1958.

Fluoride and ash analyses of the rib, iliac crest and vertebra were made for sixty-nine persons. Thirty-six of these individuals had been exposed to 1.0 to 4.0 p.p.m. fluoride for ten to seventy-six years. The other thirty-three had lived in areas with less than 1.0 p.p.m. fluoride

for ten to eighty-seven years. Microscopic examinations of the majority of these bones had been made by Geever et al. (*Pub. Health Rep.*, 73: 721, 1958). Most of the persons whose bones were examined in these studies died suddenly due to trauma, coronary heart disease and cerebrovascular accidents. Bones of persons with chronic illness or diseases known to affect bone structure were excluded from the microscopic study but were included in the chemical analyses. These cases included three individuals with malignancies and three with renal disease. The thirty-three individuals, twenty-seven to eighty-seven years of age, who had lived in areas where the water supply contained 0.1 to 0.4 p.p.m. fluoride had fluoride levels of 0.041, 0.050 and 0.054 per cent for the iliac crest, the rib and the vertebra, respectively. Five individuals sixty-four to eighty-five years of age from Grand Rapids, Michigan, after twelve years of fluoridation at 1 p.p.m. had fluoride values of 0.138, 0.139 and 0.160 per cent for the same bones. Twenty-seven individuals from Colorado Springs, Colorado and Amarillo, Texas, where the water supply contained 2.6 p.p.m. fluoride had average fluoride values of 0.267, 0.257 and 0.286 per cent, respectively, in the iliac crest, the rib and the vertebra. In Lubbock, Texas, four individuals had average fluoride values of 0.413, 0.398 and 0.411 per cent, respectively. Some samples of intervertebral cartilage were analyzed and found to contain considerably less fluoride than the bones. There was no evidence from these data to suggest that the degree of calcification of the intervertebral cartilage had been influenced by the different levels of fluoride. These fluoride data coupled with the microscopic studies of the preceding paper constitute substantial evidence that these levels of fluoride may be present in the bones without producing any apparent tissue damage. It is also noteworthy that the six individuals with malignancy and renal disease had fluoride values that were not significantly different from the averages of their groups in view of variations encountered for the other individuals. J. H. SHAW

Fluorine in Human Bone Related to Age and the Water Supply of Different Regions. D. Jackson and S. M. Weidmann. *J. Path. & Bact.*, 76: 451, 1958.

Fluoride analyses were made on the cancellous portion of the sixth rib of individuals from Leeds where the drinking water contained virtually no fluorides and from South Shields and West Hartlepool where the water contained 0.8 and 1.9 p.p.m. of fluorides, respectively. The authors indicated that these levels were lower today than ten years ago by undetermined amounts due to recent admixtures with lower fluoride-containing waters. The necropsies from which these samples were obtained were largely on individuals who had died suddenly. Only cases of known bone disease were excluded. It could not be guaranteed that the individuals had lived for a lifetime in the area in which the necropsy was made although efforts were made to confirm to this requirement. Forty-two samples were available from Leeds representing individuals from twelve to eighty-eight years of age. Twenty-seven samples were available from South Shields representing individuals from thirty-eight to eighty years of age. Fifty-six samples were available from West Hartlepool from individuals from one day of age to eighty-five years of age. In all three communities, the fluoride concentration in the cancellous bone increased with age until a plateau was reached. In this plateau, the average fluoride concentration of the people from Leeds was 1,900 p.p.m., those from South Shields 2,450 and those from West Hartlepool was 4,000 p.p.m. These values are a great deal higher than for comparable individuals from communities in the United States. The authors pointed out that the present samples were from cancellous bone which tends to run about twice as high in fluorides as compact bone. In addition, the authors commented upon the possibility that tea-drinking in England would provide about 1 mg. of fluoride per day to the adult population; this amount would be rarely provided to United States citizens because of their lesser preference for tea. J. H. SHAW

Pathological Studies in Man After Prolonged Ingestion of Fluoride in Drinking Water. E. F. Geever, N. C. Leone, P. Geiser and J. E. Lieberman. *Pub. Health Rep.*, 73: 721, 1958.

Microscopic examinations were made of ninety-nine bone samples from thirty-seven persons coming to autopsy who had resided ten years or more in communities where the water contained 1 to 4 p.p.m. of naturally occurring or artificially added fluoride. Ninety-four bone specimens from thirty-three persons who had lived in areas where the drinking water contained less than 0.5 p.p.m. fluoride were used for controls. Fluoride determinations were made on many of these bones by Zipkin et al. (*Pub. Health Rep.*, 73: 732, 1958). The areas of the bones selected in most cases were: the body of a lumbar vertebra, a portion of iliac crest and the sixth rib. In addition, the lumbar intervertebral joints were examined for possible changes in the articular cartilage. Occasionally the sternum was also studied. On the basis of these histological studies, which included a variety of measurements in addition to critical visual examination, no significant differences were observed between the fluoride-exposed group and the controls that could be related to fluoride intake. Microscopic changes in the bones and joints incidental to aging and due to nonfluoride-related conditions were observed in both series. Nothing comparable to Roholm's findings in chronic fluorosis of calcification of marginal tissues, ligaments and tendons was observed. Focal calcification and cartilaginous changes of the periosteum and adjacent tendon or fascia of the iliac crest were seen with equal frequency and intensity in both the control and fluoride groups and were interpreted as normal.

J. H. SHAW

Pathologic Studies in Man after Prolonged Ingestion of Fluoride in Drinking Water. I. Necropsy Findings in a Community with a Water Level of 2.5 p.p.m. E. F. Geever, N. C. Leone, P. Geiser and J. Lieberman. *J. Am. Dent. A.*, 56: 499, 1958.

During the years between 1947 and 1953, 728 necropsies were performed on individuals ten years old or older by the senior author or by resident physicians in training under his direct supervision in Colorado Springs where the water supply contains 2.5 p.p.m. of fluorides. There were 188 persons in this series who had lived in Colorado Springs for less than five years, 130 from five to twenty years, and 334 for over twenty years. The remaining seventy-six persons had lived there for unknown periods. The available data from these necropsies were classified according to the major cause of death, contributory causes and incidental pathologic conditions within the four groups separated in accordance with length of residence. One of every four necropsy protocols showed the major cause of death to be neoplasm, a total of 28.8 per cent. Diseases of the cardiovascular system comprised 34.5 per cent. Certain differences between length of residence and the number of deaths due to cardiovascular conditions and to neoplastic groups were observed. The authors stated: "It would be as unreasonable to attribute an apparent beneficial effect to fluoride in reducing deaths from cardiovascular conditions in the long term residency group as it would to attribute to it a deleterious effect in elevating deaths from new growths." In the over-all conclusions, the authors stated that the comparative statistical analyses of the pathologic findings revealed no significant differences which could be related to prolonged residence in this evironment or to the fluoride content of the water in the community. A further series of necropsies undertaken between 1955 and 1957 with a detailed examination of the bones is to be reported. J. H. SHAW

The dynamics of fluoride deposition in dental enamel are dependent upon the stage of development of the tooth at which a certain concentration of fluoride is achieved. The effect of an increasing fluoride content in enamel is that of decreasing its solubility although other factors are important in this function.

The Relation of Fluoride in the Drinking Water to the Distribution of Fluoride in Enamel. S. Isaac, F. Brudevold, F. A. Smith and D. E. Gardner. *J. Dent. Res.*, 37: 318, 1958.

Fluoride concentrations were determined in the various layers of enamel from teeth of persons who lived in Buffalo, New York, Chicago, Illinois, McKinney, Texas and Post, Texas where the water supply contains 0.1, 1.0 and 5.0 p.p.m. fluoride, respectively. In addition, the teeth were grouped according to whether they were deciduous, unerupted permanent, from persons less than twenty years old, between thirty and forty-nine years old or over fifty years old.

In every group of teeth, there was a much higher fluoride concentration in the enamel surface than in the inner enamel. When the concentration of fluoride in the over fifty year old group was compared with the under twenty year old group for the 0.1 and 1.0 p.p.m. water supplies, a higher concentration was observed for the older groups for both surface and inner enamel layers. The difference in the surface layer was much greater than for the inner layer.

The fluoride values for the teeth from the 5.0 p.p.m. area were much higher for all enamel layers than comparable layers from teeth from lower fluoride communities. However, the fluoride concentrations in the outer layer of three different age groups were almost identical. Evidently the fluoride concentration attained during the development and calcification of the surface layer in the high fluoride area was sufficiently high that more could not be accumulated posteruptively. However, the inner layers of the older teeth in the 5.0 p.p.m. fluoride area were higher than the comparable layers from the younger age groups.

These data further substantiate earlier observations on the fluoride concentration gradient in the enamel and on the posteruptive accumulation of fluorides in the enamel in addition to what was deposited there developmentally. However, again no correlation was observed between fluoride concentration in the enamel and caries initiation or immunity within any equivalent level of fluoride ingestion. J. H. SHAW

Solubility Rate and Natural Fluoride Content of Surface and Subsurface Enamel. S. Isaac, F. Brudevold, F. A. Smith and D. E. Gardner. *J. Dent. Res.*, 37: 254, 1958.

The solubility of surface and subsurface layers of enamel was tested in buffers of pH 4.0, 4.5 and 5.0. The teeth had been obtained from persons who were born and had lived continuously in cities where the water supply contained either 0.1, 1.0 or 5.0 p.p.m. fluoride. The teeth were grouped into deciduous, unerupted permanent, and erupted permanent from persons under twenty years of age and over fifty years of age. Solubility of the enamel routinely increased from the outer layer to the innermost layer. The greatest increase in solubility occurred between the first and second outer layers. Within each group of teeth, the fluoride concentration of successive layers decreased as the solubility of the respective layers increased. However, enamel with comparable fluoride levels showed different solubilities which was indicative of other factors controlling solubility in addition to or instead of the fluoride concentration. Mottled enamel with the highest fluoride concentration was more resistant to acid than was enamel from the other groups; deciduous enamel with the lowest fluoride concentration had the highest solubility.

The difference in solubility between outer and inner enamel layers was not related to the organic content of the layers. Likewise age and enamel solubility appeared

to be unrelated despite the correlation between increasing age and increasing fluoride concentration.

J. H. SHAW

Fluoride Placental Transfer in the Rat. G. Buttner and J. C. Muhler. *J. Dent. Res.*, 37: 326, 1958.

The extent of fluoride transfer across the placenta was studied in fourteen pairs of adult rats. Two pairs of rats were represented in each of seven groups which received supplements of 0, 1, 3, 5, 10, 25 and 50 p.p.m. fluoride as sodium fluoride in redistilled fluorine-free water. All groups received the same stock corn diet which contained approximately 1.0 μg. fluoride/gm. After delivery, two pups from each litter were sacrificed at birth, two at ten days and two at thirty days of age. The whole carcasses were ashed and determinations made of the total fluoride deposition. The number of rats born varied from thirteen to thirty-five per group with the highest number by chance in the group with the 50 p.p.m. fluoride supplement. The number of surviving pups per litter varied from 3.0 to 4.0 with 3.6 in the group with the 50 p.p.m. fluoride and 4.0 in the unsupplemented control group.

Fluoride concentrations and total carcass fluoride values were about the same for the one-day old pups from the four groups receiving 0, 1, 3 and 5 p.p.m. fluoride. At 10 p.p.m. of fluoride and above, the levels of fluoride in the one-day old pups increased until both the fluoride concentration and total carcass fluoride in the 50 p.p.m. group were double these levels in the 5 p.p.m. group. Similar results were observed in the ten-day old pups, in which case not only is placental transfer involved but also transfer across the membranes of the mammary gland. In other words, both placental and mammary fluoride transfer occur in the rat, and a level of 10 p.p.m. fluoride or more in the drinking water has occurred prior to major increases being observed above the baseline. However, attention should be drawn to the fact that very definite amounts of fluoride were present in the carcasses of one-day old pups whose mothers had received no fluoride supplement. It should also be remembered that in all tests on fluoride and caries susceptibility in the rat, approximately ten to twenty times as high levels of ingestion are required to attain the same degree of benefit as in human beings.

J. H. SHAW

Urinary Fluorine Levels of Children and Adults. I. Gdalia. *J. Dent. Res.*, 37: 601, 1958.

Urinary samples were collected from fifty-nine small children (one to six years old) and thirty-four adults (twenty to fifty-five years old) residing in Jerusalem where the water supply contains 0.5 to 0.6 p.p.m. fluorides. Fluoride values in the urine were expressed on the basis of parts per million rather than the total amount of fluoride excreted in a twenty-four–hour period. While this manner of collecting data was unavoidable, it causes undesirable basic assumptions to be made in the interpretation of the data. The mean urinary fluoride concentration of the fifty-nine children was 0.2 p.p.m. whereas the value for the thirty-four adults was 0.52 p.p.m. A further age difference was noted in that the thirty-one children between one and three years of age had an average urinary fluoride excretion of 0.14 p.p.m. while the value for the twenty-eight children between four and six years of age was 0.27 p.p.m.

The author concluded that the difference between the fluoride excretion concentrations for children and adults was attributable to a greater rate of storage in the skeletal tissues of children. While part of the difference may be attributable to deposition in the bones of children because of the rapid growth and calcification of the bones during childhood, the present study without any knowledge of the total fluoride ingested or the total amount excreted by the individuals under investigation has little potential to provide evidence on the actual amount being stored. The data presented in this paper may indicate only that adults consume more fluorides daily because of a greater consumption of water, beverages made from water and foods cooked in water than do children in whom a high percentage the nutrients in early life may be supplied by milk which is routinely low in fluorides. J. H. SHAW

ITEM OF GENERAL INTEREST

Effect of Ethionine on the Cortisone-Evoked Stimulation of Tryptophan Peroxidase-Oxidase Activity. H. R. Horton and J. M. Franz. *Endocrinology*, 64: 258, 1959.

It has been found in the past that activity of the enzyme tryptophan peroxidase-oxidase (TPO) is increased after the administration of tryptophan, cortisone or hydrocortisone. The current idea is that tryptophan stimulation of enzyme activity is due to induced synthesis of the enzyme, an adaptation phenomenon. Other data showed that the tryptophan-induced increase in TPO activity is prevented by feeding ethionine, a metabolic analog of methionine. This effect is probably due to blocking of the incorporation of methionine into the protein molecule. Since the mechanism of the steroid-induced increase in TPO activity was unknown, the authors investigated the effects of the concomitant administration of ethionine and cortisone, and also ethionine, methionine and cortisone. When ethionine and cortisone were given together, the stimulatory effect of the hormone was greatly reduced but when methionine and ethionine were given along with cortisone, the increase in enzyme activity characteristic of cortisone administration took place. It is therefore believed that the adrenal steroids as well as tryptophan cause *de novo* synthesis of TPO.

Continued study of the effects of cortisone and similar hormones has revealed that these substances affect many enzyme systems. It seems likely that studies of this type will eventually elucidate the mechanism of action of this hormone. A. B. EISENSTEIN